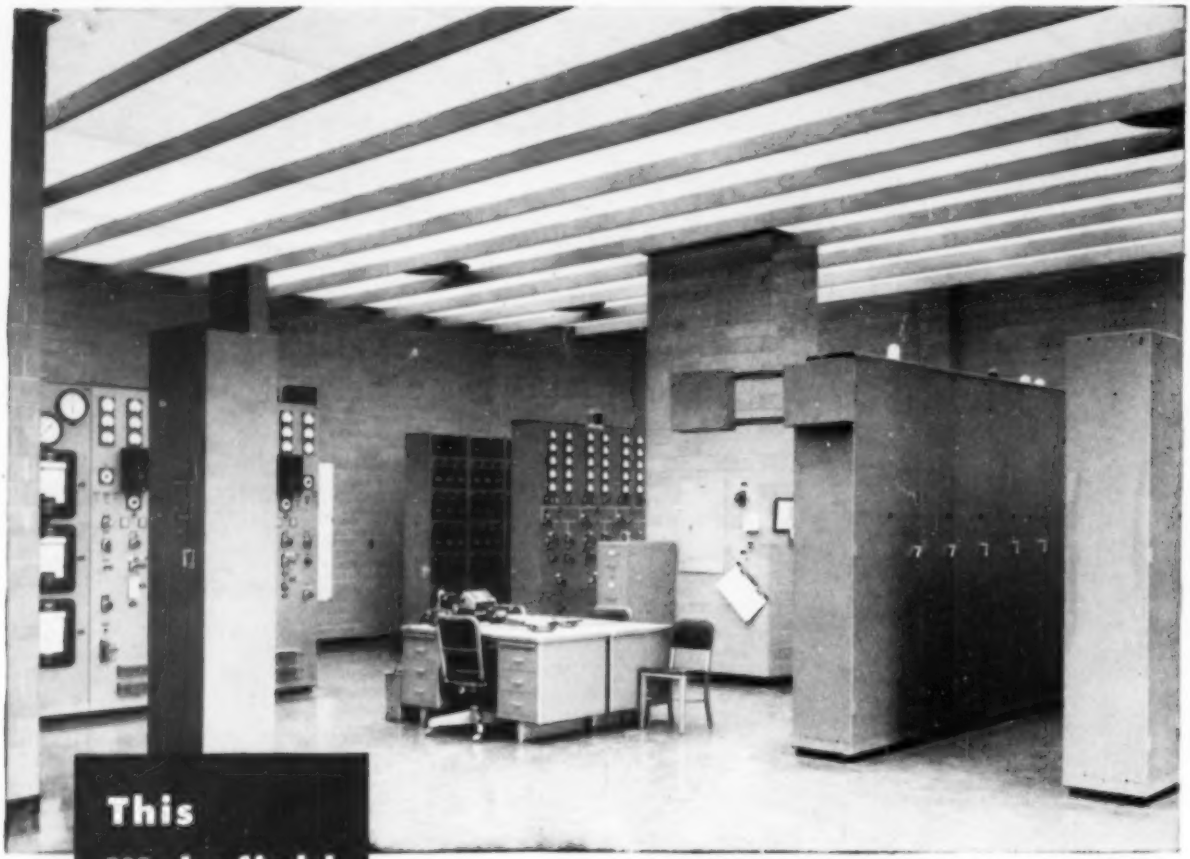
ILLUMINATING ENGINEERING

OCTOBER 1954

Lighting Combined with Structural Elements
An Interior Designer Looks at Lighting
Solutions to a Home Lighting Problem
Light and Color in Post Offices
Discomfort Glare Evaluation
Some Outdoor Applications
New I.E.S. Officers

THE JOURNAL OF THE ILLUMINATING ENGINEERING SOCIETY

A Control Room with Everything Under Control



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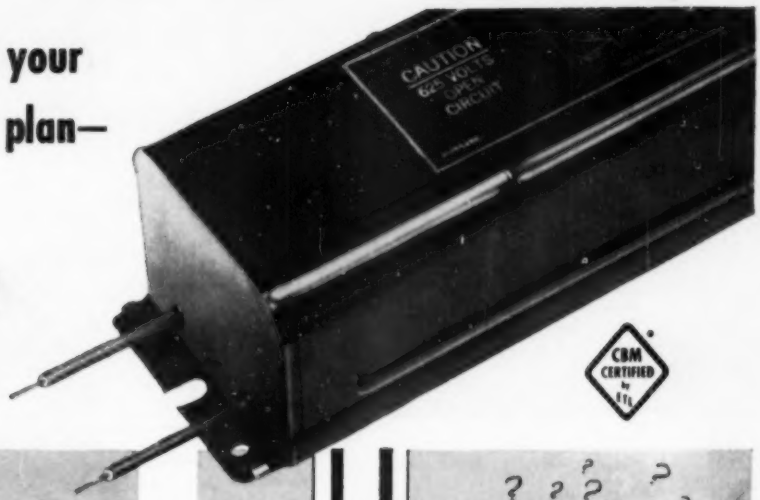

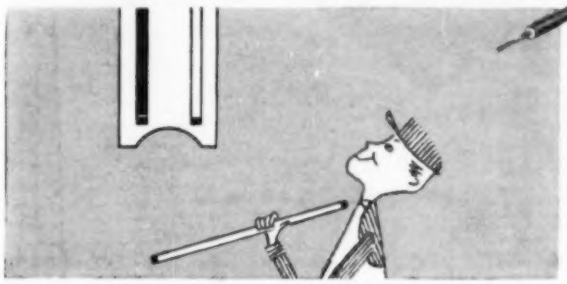

Lead-Lag—When outage of a single lamp occurs in a group of lamps operated on two-lamp *lead-lag* ballasts, the lumen output of the other lamp is not affected.

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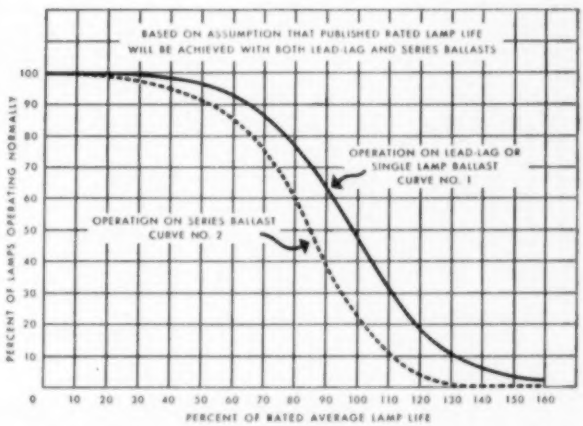
Compare these curves. You will see an important increase in economy of *lead-lag* over series operation for installations using group lamp replacement. This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RATING watts 73.6 volts 118 ma. 425 cycles 60 DATE TESTED 8/10/54-8/12/54 TESTED BY R.T.C. DATA APPROVED HHC

ETL SPEC. NO.	CIRCUIT	SUPPLY VOLTAGE VOLTS	DESIGN SPEC CIRCUIT VOLTAGE VOLTS AT MFR. INPUT	AT LINE INPUT	INPUT TO REFERENCE LAMPS VOLTAGE VOLTS	MA. CURRENT MA	POWER WATTS	PEAK CURRENT MA	RATIO PEAK TO MIN. CURRENT	FREQUENCY CPS	OPEN CIRCUIT VOLTS AT 1000 MA. AT ENTER VOLTS	OPEN CIRCUIT VOLTS AT 1000 MA. AT RATED VOLTS	STARTING TIME SEC.	VOLTAGE ACROSS STARTER TERMINALS AT RATED VOLTS	DIELECTRIC STRENGTH TEST	IGN. RES. OHMS	TIME SEC.	AMBIENT TEMP. C	HEATING TEST TOTAL WEIGHTS LOSS Start gm/hr	Run gm/hr	CIRCUIT TEMP. C
Rated Current																					
"		430	—	—	196.0	0.428	74.0	—	—	—	—	—							SPECIMEN NO. 8-52-Normal		
"		425	—	—	202.0	0.378	66.4	—	—	—	—	—		Discontinued Test Burnt.							
"		424	—	—	176.0	0.430	74.4	—	—	—	—	—		Fluo. Temp. C		41	3790	4/48			
F-78	Rated	118	57.6	68.8	176.0	0.418	72.8	—	—	—	—	—		Amp. Ratio C			88.0	94.5			
	10%	"			—	0.428	76.0	0.780	1.66	—	—	—		Temp. Ratio C			48.0	52.5			
F-79	Rated	"	59.0	70.8	—	0.390	72.3	—	—	—	427	427		Ind. Resist. Ω		40	4537	4936			
	10%	"			—	0.428	76.4	0.680	1.67	—	—	—									
F-80	Rated	118	58.2	—	—	0.380	75.0	—	—	—	249	248									
	10%	"			—	—	77.0	—	—	—	—	—									
	Rated	118	—	—	—	0.428	73.7	0.670	1.61	—	—	—									
	10%	"			—	0.368	78.5	—	—	—	—	—		Lamps on Rack - 1st lamp in Black							
F-81	Rated	430	—	68.9	—	—	72.0	—	—	—	226	226		Fluo. Temp. C			14.5	13.0			
	10%	106	58.5	—	—	—	82.5	—	—	—	—	—		Amp. Ratio C			14.5	13.0			
	Rated	118	—	—	—	0.418	74.4	0.630	1.64	—	—	—		Ind. Resist. Ω		40	4.98	4.78			
	10%	"			—	0.478	78.4	—	—	—	—	—									
F-82	Rated	106	67.8	—	—	—	77.2	—	—	—	227	224									
	10%	106	—	—	—	—	64.7	—	—	—	—	—									
	Rated	118	67.5	—	—	0.408	76.4	0.660	1.63	—	—	—									
	10%	118	—	—	—	0.372	68.3	—	—	—	—	—									
	Rated	430	—	68.0	—	—	74.0	—	—	—	229	224									
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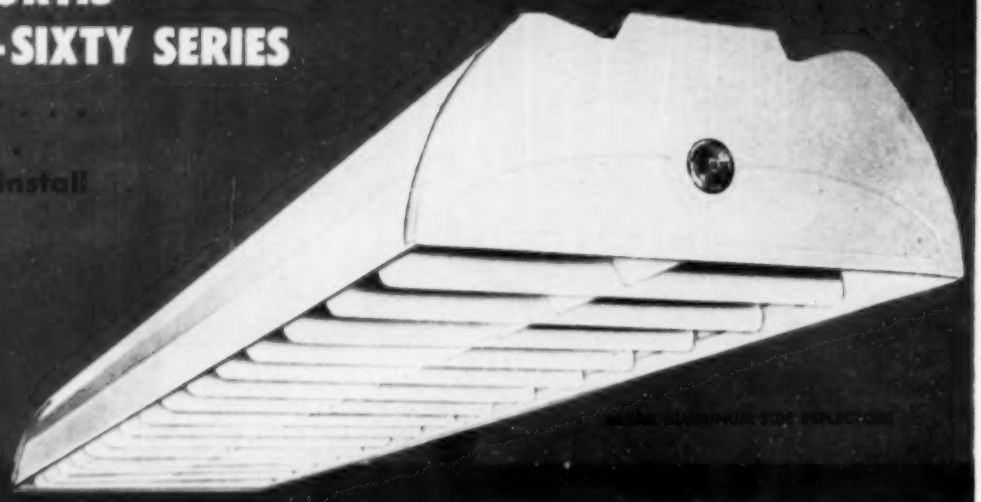

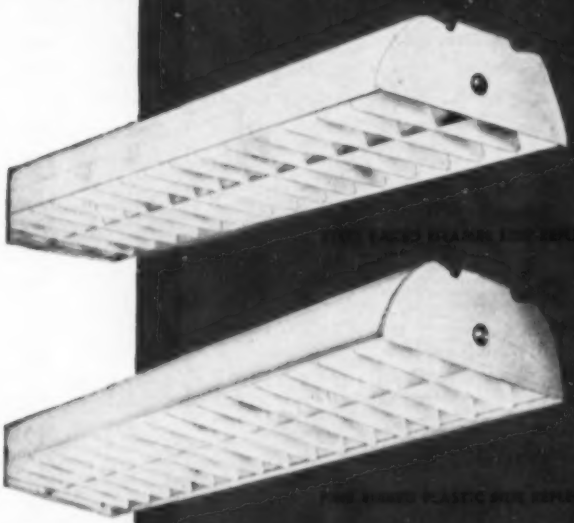

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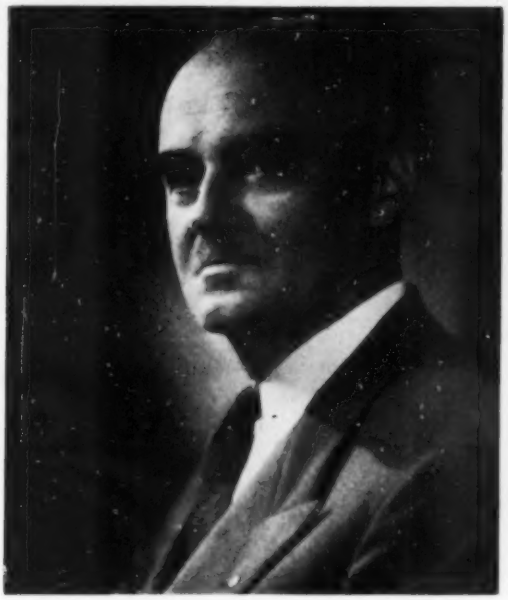


Duncan M. Jones, President

Illuminating Engineering Society—1954-1955

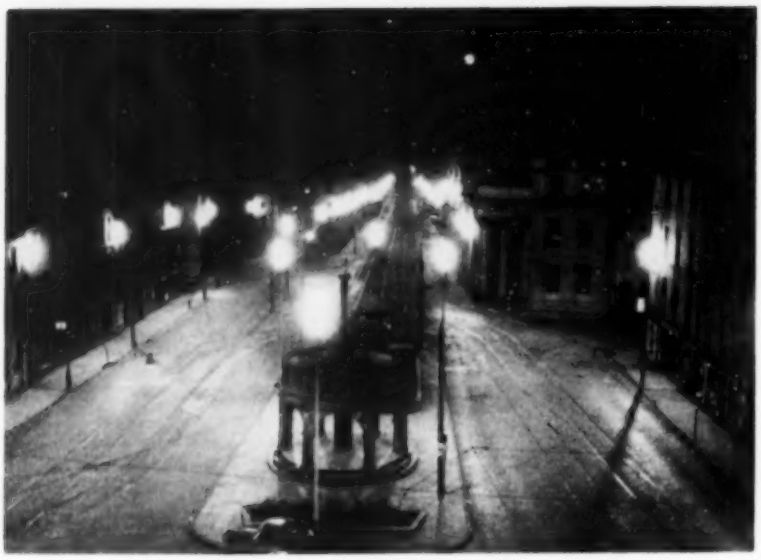
TO CANADIAN members, the 1954-1955 President of the Illuminating Engineering Society needs no introduction. He has for many years been a leading figure in Society affairs and in the progress of the lighting industry in Canada. Outstanding service to both has led him to the top office in I.E.S., the first Canadian to be so elected. Mr. Jones' industry affiliation is with Curtis Lighting of Canada, Ltd., Montreal, with whom he has served since 1933 as representative for Eastern Canada.

Duncan Jones was born and educated in Montreal. His enrollment in McGill University there, in 1916, coincided with his country's need for young men for the first World War. He enlisted that same year in the Royal Air Force, nipping in the bud his early ambitions to become a surgeon. This chance detour, however, was to the gain of the lighting industry: electrical studies during his pilot's course, and temporary work with the Canadian General Electric Company while waiting to be called, determined once and for all his future plans. Upon discharge from the services in 1919, he returned to Canadian G.E. in Montreal, and devoted the following five years to studies of illumination as well as field application of its principles.

In 1925 Mr. Jones joined the Holophane Company, Newark, Ohio, as street lighting engineer. He became a familiar figure in this field, appearing before numerous meetings as speaker, serving as Chairman of the Committee on Illumination of the U. S. National Highway Traffic Association.

Election to President of I.E.S. is seldom reached without many years of service to the Society. In this connection Mr. Jones' contributions are especially distinguished. An active worker locally long before there was even a Chapter in Montreal, he was instrumental in 1933 in establishing a chartered I.E.S. group there. As Regional Vice-President for the Canadian Region in 1947-1949, Mr. Jones spearheaded a remarkable growth of I.E.S. in Canada, and an increasing interest in the science of illumination. A noteworthy outcome of this interest was the formation of four new I.E.S. Chapters in Canada, all during his term as Regional Vice-President. Mr. Jones has been a member of Council continuously since 1947, serving a term also as Director, to which post he was elected in 1949, and two terms as Vice-President.

Mr. Jones' interest in furthering the professional aims of I.E.S. remains a dominant feature of his personality. In his personal visits throughout the Regions next Spring, members can expect to meet an outstanding leader in Society affairs.



STREET SEEN IN ABERDEEN

TWO of the main streets in Aberdeen, Scotland's third city, have recently been re-lighted using cold cathode luminaires, for the most part wall-mounted. The units consist of an opal plastic cylinder, with decorative aluminum fittings, containing five 67½-watt lamps. Wall brackets have been specially designed to allow the units to be removed for maintenance without disturbing the wall attachments. Life of the cold cathode source is rated at over 15,000 hours.

Although the majority of the luminaires are mounted directly on the building walls, in some cases special brackets are used to achieve uniformity in projection and mounting height. And, where needed, posts are used, as on the safety island (in photo above) and in front of St. Nicholas Kirk (below right).

Reflected light from the granite buildings is an important factor in lighting a wide street with wall-mounted luminaires. A statutory power of the Aberdeen Council helps maintain this factor, since property owners can be compelled to clean building exteriors when it is considered necessary.

Data submitted by C. E. Tiffen, of Staines, Middlesex, England. Photos courtesy General Electric Company Limited, Great Britain.

The Interior Designer Looks at Lighting

By C. EUGENE STEPHENSON, A.I.D.

THE RECIPE for successful interior design and decoration, whether commercial or residential is composed of many various ingredients; it must have among its numerous elements a good proportion of, or at least some of, the following:

1. Color
2. Form or composition
3. Practicality
4. Originality
5. Good layout or arrangement
6. Good lighting.

The last named is being recognized more and more as one of the most necessary ingredients and certainly one that to a great degree determines the success of the room or area designed.

I have seen many beautiful rooms that lacked one or two of the enumerated ingredients; perhaps practicality or good layout, but I have never seen a successful room that had not had careful attention paid to its lighting design. Interesting and well planned lighting has a way of "selling" a room that no other quality or element can imitate. Most interior designers and decorators recognize this fact and spend many hours endeavoring to create beautiful rooms which they know must be skillfully lighted before they are judged a success.

To the interior designer the lighting must succeed in three different ways:

1. Effectively — Effective lighting is that which does the job best, measured by standards recognized and proven. This is the primary consideration for the lighting planned. It must interpret the room as well after dark as during the day, when daylight or streaming sunshine defines its composition, softens or sharpens its shadows, picks up its highlights, moulds its pleasing contours and splashes upon its colors. Most designers when creating interiors, visualize them either with bright sunshine streaming through clear, clean windows, or lighted for night use; sometimes and usually both. They seldom visualize rooms on a dull cloudy day with no lamps lighted. They think in terms of light, either nature's or man made.

2. Emotionally and aesthetically — A great many laymen probably would not think of applying the word "emotional" to a lighting design. But to designers of "shells for living," lighting must function from this standpoint too. A great deal of the emotional aspect of lighting is determined by colors and textures on which it falls. But there are also ways of applying the various methods of lighting which accentuate and supplement both of these. Some schemes call for a bold, direct means of illumination, others depend for their result, upon soft translucence or suggested light, understated. In my own recipes of successful decoration I have used what I sometimes refer to as "mood lights." These are usually nothing more than contrived effects based calculatingly upon a sense of the dramatic, nostalgic, or "atmosphere." In a traditional living room or bedroom there could be old oil lamps converted and electrified with 7-watt lamps that glow through opalescent, spherical globes. But they do add an emotional appeal to the room. I once had a client who used to say that a pair of such lamps in a pleasant country living-room gave her a sense of "tranquility and peace." The mood was established to a great degree by the soft light of a simulated era of the past, with which she associated the lighting effect. Subtle architectural forms which contained additional light were introduced to carry the functional requirements of the room. The obvious sources of light were a foil to create the mood and quality of the room.

Interior designers and decorators, more than any other professional creative people, except perhaps the stage, depend upon "atmosphere" lighting as much as any other element to help sell their job. The designer of a large store employs its subtle effects to "sell" groups of correlated and grouped merchandise, to direct traffic flow to some degree, to establish a sense of comfort in the proper areas, and sometimes to get you out of the store when you have overstayed your buying hours.

The hotel designer knows how to devise clever lighting to stimulate your appetite for food and drink, to invite you to linger longer in a dusky

A paper presented at the National Technical Conference of the Illuminating Engineering Society, September 13-17, 1954, Atlantic City, N. J. AUTHOR: National President, American Institute of Decorators, 41 E. 57th St., New York, N. Y.

corner over that extra one before departing and to make you feel you look glamorous when executing that tricky samba or waltz. Mood lighting again in its infinite varieties helps him to design a successful interior.

While the stage and the motion picture designer does not necessarily figure in this group, his artful devices have found expression in recent trends in interior design and decoration. We have lights that are adjustable up or down, sideways or what ever is desired. We have group spot-lights on poles, that are movable and adjustable for area lighting and any number of various uses. Ten years ago these would have been considered extreme by home owners. Today we can not imagine a contemporary house without some of them.

Lighting can make a cold, impersonal interior such as a bank or railroad station much more beautiful and meaningful. It can also dramatize areas, call attention to specific places, and create a feeling of substantiality and permanence.

Business interiors, which cater to the public and groups of consumers require perhaps a more detailed study and use of aesthetic lighting than other groups. Doctors' waiting rooms, often lighted with a group of table lamps and/or floor lamps could benefit tremendously by an improved and more imaginative type of lighting. Most patients are very susceptible to a good lighting plan here, supplemented by an attractive, restful color scheme, eye comfort as well as physical comfort, an easy spot to rest the eye as well as a deep and easy chair to relax the body. Relaxed eye tension can add immeasurably to a relaxed physical condition.

Hospitals have learned the difference between color schemes that relax and reassure their patients and annoying or upsetting color arrangements that destroy the recuperative purpose of a stay in the hospital. They could learn a great deal too about lighting recipes and arrangements that would help equally as well to assist their patients to recover.

One of the most exciting uses of aesthetic lighting I can recall was that employed during the last World's Fair on Flushing Meadows for the pleasure and enjoyment of thousands watching the fountains in the International area. When combined with the elements, fire and water, light became a magnificently moving force and quality.

3. Creatively — What is creative lighting? As designers work with new materials, so they also can and should work and plan with new types and formulas of "creative light and lighting." It is the privilege as well as the responsibility of interior designers to extend their creative thinking into the realm of a light control and use above and beyond that which is commonly practiced today. The nature of their thinking, visual as it is, demands, if for no other reason, advanced achievements. They usually know what they want, but not always how they can achieve it. The desired result is usually based upon some well planned scheme which of necessity must be understood by the collaborating technician to result in a successful job. Creative lighting therefore is not necessarily a "one man job" as the designer knows. He should therefore be most conscious of the following point which is the necessity for greater collaboration and understanding of mutual problems by the illuminating engineer and the interior designer-decorator.

Most decorating ideas, creatively, take form, even if only a sketch or "doodle," before the designer has gotten into the "how" or practical department of executing them. Designers have a way of "thinking" with a pencil or brush. Great original ideas are no respecters of time and are apt to occur at any time of day or night, as we all know. And so we progress after our ideas assume concrete form, into the practical planning stage. We have already arrived at a generalized solution which must first provide for all the prescribed living requirements. After that we select forms, usually first, colors second and details, usually last. Somewhere along those processes of thought the original plan should be checked, especially color as related to lighting, before the total thinking has been completed. If more designers realized that the experience of capable lighting specialists were available and that such qualified help could be of tremendous assistance with their lighting problems, they perhaps would be more inclined to avail themselves of such advice. The services of a qualified lighting specialist should be considered as a normal element of cost, and be made a part of the design fee. Both groups of people, the interior designers and the lighting specialists are creative, vital forces which need to understand each other better and also to develop methods of operation for working and thinking and planning together.

Some interior designers have an unfortunate "ego" in their relations with the trades and other professions which to some degree is their own fault, and perhaps too, is misunderstood. For fear of being thought uninformed on lighting and its complex functions they reject helpful advice, or because they believe through any changes or improvements in their planning or designing it may be spoiled, they hesitate to seek that technical advice. If better and improved relationships can be promoted and furthered through a definite effort on

the part of both groups, I am sure we will find the quality and quantity of resulting jobs appreciably larger. A designer's attitude toward his own creative efforts might be compared to that of a composer. He wants the beautiful harmony and rhythms of the work to be his own. Other cadences and orchestrations are not, to his way of thinking, at all necessary or even wanted. He does not realize that by taking advantage of the help of the technician he can increase the importance of his "chamber music" to that of a "symphony." Better orchestration in the form of the lighting specialist playing up the good points can make just that difference.

A suggested way of bringing the two groups of creative thinkers closer together might be for each to study more about the interests and problems of the other group. Appreciation of the individual problems of both would make for much greater understanding. Let us look at some of the problems which constantly beset interior designers:—

A. How to properly light rooms that have been created to have certain color values and effects. As noted before, the change that occurs after dark sometimes destroys the beauty or quality of the room. With good and successful lighting design the room could be even *more beautiful* than before, because the sources and talents of the specialist when added to those of the designer can make wonderful improvements in his planning. Warm or cool color schemes can be accentuated. Shadows or lack of them can add drama and charm. Many designer-decorators have never seen the changes correct fluorescent lighting can make in interiors, except perhaps at the local butcher shop which might be wrong and very unpalatable. If they have the interest, incentive and time to take advantage of offered courses and other basic and advance information their field of design and decoration can be widened considerably.

B. How to maintain a quality of design in certain interiors so they do not look "commercial." One common criticism leveled at rooms that have been designed without the collaboration of the interior designer is that they tend to look "commercial." Rather than establish what "commercial" means, let us say that with the use of certain types of lighting equipment usually found in stores, shops, hotels, etc., the rooms lose something of their personality and good taste. I am sure that such a criticism need not apply to well designed and planned interiors if the rooms have the combined talents and know-how of both the designer and specialist from the beginning. The obvious and stereotyped is avoided and a much better result obtained. It is up to the specialist to "call our shots" and help us avoid the commonplace. A common understanding of what we "want" on one hand, and what we can "have" on the other, may make just the difference between a dull job and a brilliant one.

It is quite possible that new types of lighting equipment and techniques will result from a better understanding between our two professions. Certainly our design limitations, once they are understood, will make us strive to use what we understand to better advantage.

My own personal observation of commercial lighting would indicate that it has far outstripped residential lighting. So much so, that I find a certain client reaction to some types of lighting used in most stores. They do not want the same type used in their homes. They feel that to do so characterizes their place of living as "commercial." We both know that there are many kinds of residential lighting available that do not remotely resemble store lighting. I am also certain that other new types of lighting will come about as the interior designer and the specialist work increasingly together.

An observant specialist can learn a great deal if he familiarizes himself with the particular "design quality" of many of our notable interior designers. By a thorough study of what elements make the designer's room his trademark, or his particular own, he can, by analyzing them determine why they do a good job and the quality of lighting and color preferred. Most successful designers have a definite style about their work. It may be crisp, fresh, sharp. Or it can be softly lighted, relaxing, low keyed. When the opportunity of collaboration with a particular designer presents itself, the specialist has much to his advantage if he is familiar with the moods and characteristics of the designer's rooms. There may, of course be many points on which he does not agree, as to the lighting technique but a knowledge of the designer's style can help immeasurably in a better understanding and collaboration between the two.

Similarly, the designer should not close his mind to techniques and developments constantly introduced in the illuminating engineering field. The successful use of a favorite technique should not mean its constant use to the exclusion of newer and better, if less known improvements. When impressed with unusual application of lighting techniques, new or old, the designer should analyze the methods and planning that make them possible.

Rooms should provide the elements of living that make up for the hurried pace, the terrific speed,

demanded of us all today. Conditioned environment that has been coordinated to provide recuperative and restorative qualities is essential. Qualities I would like to be able to observe in room design might be the absence of all *exposed* lighting sources or fixtures except lighting fixtures that add a design or decorative quality such as the fine 18th and 19th Century chandeliers. But we can not use 18th Century fixtures in all interiors. There *must* be, however, with all the skill and materials available, a whole new world of design ahead that can supply this great need. We should have correlated design of residential fixtures for a complete house, consisting of *at least*, a living-dining room, two bedrooms, kitchen, hallway, bath and utility room. The designer might take a fundamental shape, change it slightly with textures and materials so that there is a compatibility of design and color throughout the whole house. I have already had the opportunity of observing how it can work for a client. Why cannot additional design research be done for all types of fixtures, fixed lighting equipment and lamps?

The chief difficulty arises from the use of incorrectly scaled fixtures, hurriedly chosen from commercial lines. With the closer viewing distances so often found in residential interiors, greater refinement of design is also required.

In the seventy-five years which have elapsed since Thomas Edison gave us light for living, we have come a great distance. The distance yet to be travelled depends upon how much we work together toward progress, efficiency, beauty and achievement.

Equipment Manufacturer Practices What He Preaches

How does a lighting equipment manufacturer light his own plant? What specifications does he make for reflectances of walls, ceiling and floor? What levels of illumination would he prescribe for the finishing, assembly and inspection of his own products?

The finishing and assembly area shown here (unfortunately in a daytime picture), in a new plant of such a manufacturer, is provided with an initial illumination of 80 footcandles by 90 8-foot and 18 4-foot industrial-type luminaires, each using two 75-watt T12 lamps. Upward component of light is 25 per cent; crosswise shielding is 35° and lengthwise 2°. The units are mounted in continuous rows on 8-foot centers at a height of 12 feet. Side panels are removable for ease of maintenance.

Ceiling of the room, which is approximately 8000 square feet in size, is painted white (80% RF), the window wall is light green (65%), two other walls green (50%) and the front wall as shown in the photograph is a pale yellow (75%).

Lighting designed by Ralph A. Yates, Wakefield Lighting Limited, London, Ontario; Electrical contractor, Jolly & White, London, Ontario; General contractor, McKay-Cocker Construction Limited.

INSTALLATION AT MILWAUKEE ATHLETIC CLUB, MILWAUKEE, WISCONSIN.

Lighting a Billiard Room

LIGHTING OBJECTIVE: To provide a uniform level of glare-free illumination over the surface of a number of billiard tables.

GENERAL INFORMATION: Fig. 2 indicates the size of this room which is decorated as indicated below:

ceiling	off-white	70% RF
bottom of cove	off-white	70% RF
walls	rose	35% RF
woodwork	light oak	40% RF
floor	green and rose rubber tile	20% RF
tables		
tops	green cloth	15% RF
sides	oak	20% RF

The structural ceiling is 13 feet 3 inches high; height to bottom of cove is 12 feet 2 inches.

INSTALLATION: The "beams" shown are prefabricated metal channels (see Fig. 3) containing two rows of 120 ma 1-inch diameter cold cathode tubing. Total length of tubing in the room is about 530 feet. Over each table recessed in the "beams" are three 10-inch square units (custom-built by the A. B. Rowold Company of Milwaukee) each containing a 150-watt filament lamp, reflector and Holophane lens (#739).

The cove provides 5 footcandles of general illumination. With the cove and lens units operating there is 35 footcandles average illumination on the table tops.

(over)

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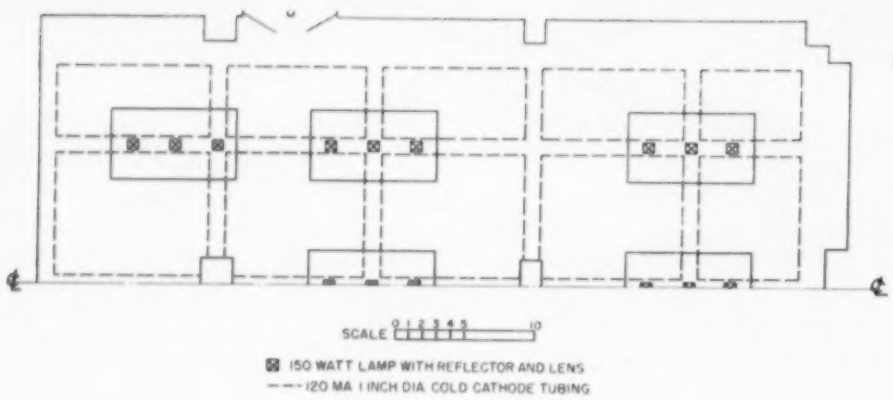


Figure 2. Plan view.

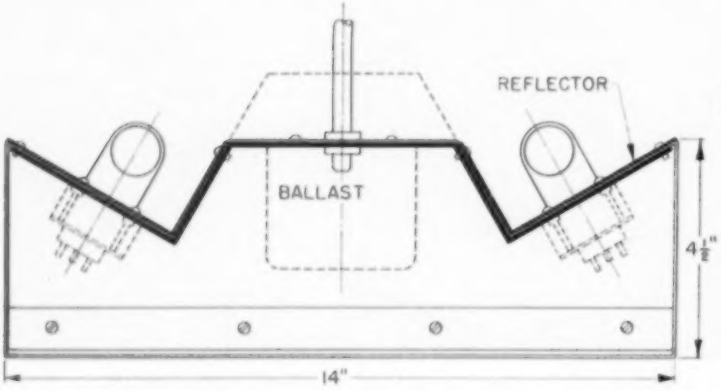
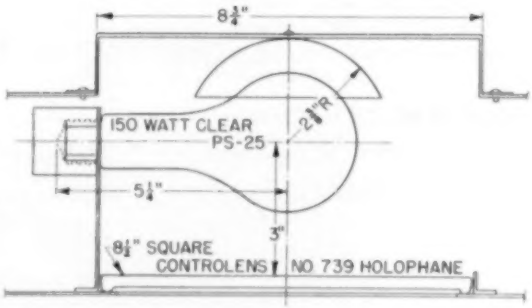


Figure 3. (left) Detail of cove.

Figure 4. (below) Detail of downlight.

Brightnesses are as follows:

Ceiling	
Immediately above cove	100 ft-L
Midway between coves	3.5 ft-L
Bottom of cove	2.0 ft-L
Table tops	
Center of table	3.3 ft-L
Ends of table	3.0 ft-L
Average brightnesses on sides of tables	2.0 ft-L
Lens units (at 45°)	400 ft-L
Floor	
Between table sides	4.0 ft-L
Between table ends	3.0 ft-L



Lighting designed by William A. Heth, Custom Lighting; architect: Eschweiler and Eschweiler; interior decoratur: William MacArthur, all of Milwaukee.

Lighting data submitted by William A. Heth, 734 North Jefferson Street, Milwaukee and William C. Kuhnke, Wisconsin Electric Power Company, Milwaukee as an example of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

Series XIX 10-54

Step-by-step technique for the successful floodlighting of an . . .

Architecturally Integrated Facade-Smoke Stack

By MELVIN COHEN

THE ARCHITECT, in designing this multi-million dollar office and warehouse building, desired to give the smoke stack a prominent position in the building facade. The stack rises 50 feet above the sidewalk and is bounded on all sides by a wafer-thin trapezoidal-shaped platform, 10 feet above the sidewalk. On the stack are 3-foot 8-inch porcelain enamel letters projecting eight inches from the stack on stainless steel supports.

Illumination of the stack was complicated by the absence of a secluded location for mounting the floodlighting equipment. The only alternative was to locate it on the canopy. Because of the restricted area of the platform, it was necessary to illuminate the stack with the minimum number of floodlights which would sacrifice neither the quantity nor the uniformity of illumination.

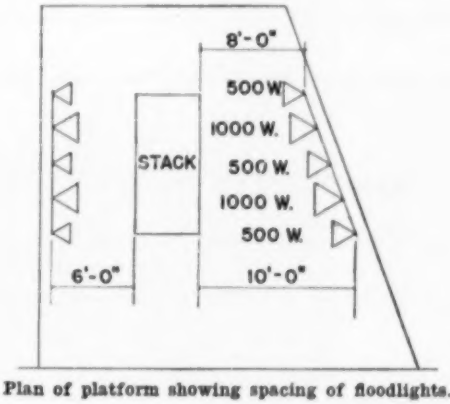
Two concentrating 1000-watt floodlights were used to illuminate the upper portion of the stack and three wide-beam 500-watt lamps for the lower portion.

AUTHOR: Electrical Engineer, A. Epstein and Sons, Inc., Architects and Engineers, Chicago, Ill. Paper submitted through the Papers Committee of the Chicago Section, I.E.S.

In accordance with I.E.S. recommendation, the design was for a level of 30 footcandles maintained. The number of lamps needed was determined as follows:

$$\text{lumens required} = \frac{\text{footcandles} \times \text{area}}{\text{maintenance factor} \times \text{coefficient of beam utilization}}$$

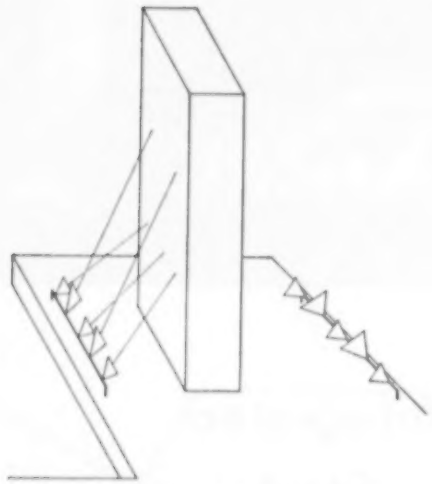
A maintenance factor of 70 per cent is usually assumed. However, to compute the coefficient of



Plan of platform showing spacing of floodlights.

TABLE I.—Data on Floodlighting Equipment.

No. of Lamps	Lamp Size	Range	Cover	Lumens per Lamp	Total Lumens	Aiming Points	
						6′ from stack	8-10′ from stack
2	1000-Watt G-40	13° Vertical 13° Horizontal	Plain	5945	11,890	77°	74°
3	500-Watt G.S.L.	50° Vertical 25° Horizontal	Ribbed	3930	11,790	56°	54°



Isometric showing aiming of floodlights.

beam utilization,[1] the aiming angles of the floodlights have to be determined.

Since the floods had to be mounted so close to the surface to be illuminated, it was necessary to determine through Descriptive Geometry the true size of the beam pattern formed on the stack by each flood to find the proper aiming point of each lamp for adequate coverage.

By drawing the true beam patterns for various beam spreads, it was determined that the most advantageous beam spread for the 1000-watt floods would be 15 degrees vertical and horizontal; and for the 500-watt floods, a spread of 45 degrees vertical and 25 degrees horizontal would be appropriate. The types of equipment most closely matching these values are given in Table I.

After finding the true size of the beam pattern at different aiming points and superimposing the beam patterns on each other, the most uniform illumination was obtained by using two 1000-watt G-40 floods and three 500-watt general service lamps with ribbed covers on each side of the canopy. Illumination on the stack was then computed by dividing the true beam pattern into sixteen sections and computing the illumination on each section by dividing the lumens on each section by the area of the respective section.[2]

Using the aiming points determined by the superimposition of the beam patterns, the C.B.U. came out to be 71 per cent; thus the maintained illumination by the I.E.S. formula was

$$E = \frac{(11{,}890 + 11{,}700)\ \text{lumens} \times .70 \times .71}{40 \times 10}$$
$$= 29.8\ \text{footcandles}$$

Illumination on the stack at a point five feet above the canopy measured 40 footcandles after six months' operation, a most satisfactory result. Later the owners added lighting standards to illuminate the parking area in front of the building. At the same time, one 1000-watt floodlight was mounted on a standard on each side of the stack in order to diffuse the shadows created by the sharp angle of incidence at which the light strikes the raised letters.

1. *I.E.S. Lighting Handbook*, Second Edition, page 9-41.
2. Hallman, E. .B.: "Floodlighting Design Procedure as Applied to Modern Setback Construction," *Trans. I.E.S.*, Vol. XXIX, No. 4 (April 1934).

Know Your I.E.S. Officers

Starting on page 5A of this issue is a photo display of the Officers, Council and Section and Chapter Chairmen of the Illuminating Engineering Society, for the coming fiscal year of 1954-1955. The news section of I.E., Telecast, follows this feature, beginning on page 13A.

Lighting Combined With Structural Elements

There are two common denominators for the installations shown in this feature. One, the lighting system is itself a structural element of the interior, and two, results achieved are from the coordinated teamwork of design consultant, illuminating engineer and electrical contractor.

In an advertising office

In this advertising and public relations office, the desire was that the interiors express current thinking in all the elements of the design. Cost of the installation was not a factor, but in addition to conforming with the decorative features of the room, the lighting must (a) be in line with recommended practice for the visual tasks involved; (b) brightness patterns must be comfortable; and (c) the lighting effect must be interesting. Close cooperation of all interested parties — the agency itself, the design consultant, equipment manufacturers, electrical contractor and the utility lighting department, resulted in a lighting design which qualified in all of these requirements. In the office below high levels (50 footcandles) with pleasing brightness patterns and decorative interest is achieved with a luminous element over the desk and recessed baffle-type downlights. The luminaire is of antiqued walnut to match the other wood in the room, using six 72-inch T8 deluxe warm lamps operated at 200 ma with corrugated translucent plastic panels, having a brightness of 235 footlamberts. The size and mounting height of the fixture are such that there is no reflected image in the desk

top from normal viewing position. In order to avoid any possibility of distributing noise and to keep the physical dimensions of the unit within certain limits, the ballasts are mounted remotely in a wall panel to the left of the desk. The picture also shows one of the six downlights used. This one is directed towards the picture on the wall for a vertical level of 25 footcandles. This type of wall lighting occurs at three other points in the room, for the illumination of advertising proposals which are tacked to the walls during staff conferences.

The installation, with the one shown below, was a prize-winning entry for J. O. Kvalston of Kvalston Electric Company, electrical contractors, Minneapolis, in the contest for My Most Interesting Lighting Job conducted by the Twin City Section of I.E.S.

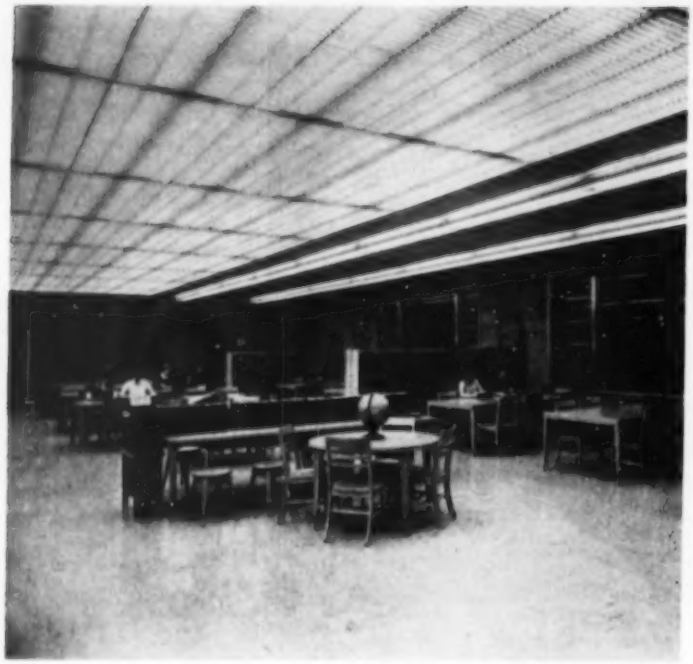
In another office of the advertising agency, Mr. Kvalston's installation blends in architecturally with the interior decorator's wish for a beam-ceiling effect and at the same time provides lighting which is adequate, comfortable and interesting. The color scheme in this office, as in the others, is a light-colored burlap wall with blue draperies, and a cream ceiling. Furniture is of walnut with varied color of upholstering; the carpet is beige. For the beam-ceiling effect desired, a luminous ceiling with vertical acoustical baffles is used. Four 40-watt T12 430 ma deluxe cool white lamps are used behind each of the six luminous panels, which provides 80 footcandles maintained on the desk top, with an average maintained in the room of 70 footcandles. The luminous ceiling has a brightness of 220 footlamberts; the baffle 50 footlamberts; the ceiling 10 ft-L; wall 25 ft-L; the floor, 15 footlamberts. A table lamp in the area, not shown in the photograph, provides variation and interest in the room.

In display and selling areas

Remodeling with "Beams and Ballasts" was the title given this prize-winning installation when it was presented before the Pittsburgh Section of I.E.S. interesting job contest. Edgar Kwallwasser, Architect, coordinated the work of illuminating engineer Aubrey G. Caplan of the Duquesne Light Company, and Jesse Bolden, Electrical Contractors, into his architectural treatment of structural as well as visual changes in this converted storage area. A former warehouse has been remodeled into attractive display and selling areas for the B. D. Lazar Company, Pittsburgh, Pa.

In the entry hall (above), to lower effectively a 16-foot ceiling at minimum cost, the architect designed a new beamed open ceiling network trellis consisting of redwood cross members spaced on 16-inch centers. Above these beams the cavity was painted out with dark paint, while below the beams a lighter treatment consisted of paneled walls, plaster, and very light tile flooring. Illumination was accomplished with three-lamp industrial units which "sit" on top of the beams, mounted perpendicular to the cross beams. Further attention is directed to the rear wall by valance lighting. To illuminate the free-standing letters, two-lamp industrial units are installed on a 30-degree slope behind the top wall board. A single lamp cove provides up-lighting over the receptionist and helps to relieve the dark ceiling monotony in this location.

Over the parts counter (below), the ceiling is further lowered by a "roof of lighting." This panel is constructed of wood, with grate-type plastic panels installed in a slot grooved in the cross members. Forty-watt strip units over each panel provide 65 footcandles on the counter top.



In a college library

Midland College Library, Fremont, Nebraska is a new building of modern interior design in which all elements of the room have been coordinated for visual comfort and pleasing appearance. In the reading room shown 90 footcandles maintained is provided with visual comfort by the planned combination of especially high reflectance of all surfaces, and a ceiling area lighting system. The center panel, 30 feet by 72 feet is made up of recessed shallow-type wide area luminaires 36 inches by 96 inches, with hinged metal louvers, 45-degree shielding, each using two 96T12 standard cool white lamps operated at 430 ma.

The off-white ceiling has a 79 per cent reflection factor; medium light walls are 52 per cent; the very light tan floor is 55 per cent RF, and the blonde furniture 50 per cent.

In the open stack area adjacent to the room, two continuous rows of matching luminaires, 13 inches by 96 inches are surface mounted, with plastic side panels, also using two 96T12 standard cool white lamps.

The installation, which was the work of D. L. Donelson, Lighting Products Inc., Omaha, Nebraska, in cooperation with the architect, took first prize in the contest for My Most Interesting Lighting Job conducted by the Cornhusker Chapter of I.E.S.

Discussion of Conference Papers

Written discussion on any of the technical papers presented at the I.E.S. 1954 National Technical Conference should be submitted immediately for publication in ILLUMINATING ENGINEERING.

Send: One copy (original) to Miss Ruby Redford, Editor, ILLUMINATING ENGINEERING, 1860 Broadway, New York 23, N. Y.
One copy to Dr. R. M. Zabel, Co-Chairman, Papers Committee, at Westinghouse Electric Corp., Bloomfield, N. J.
One copy to the author of the paper.

Light and Color Engineering in Post Offices

By TOM C. CARGILL, JR.
CURTIS E. KAUTT

THE Post Office Department is Big Business. In its 40,000 post offices it employs 500,000 people to sort, transport, and deliver the five million tons of mail matter posted annually. In handling this staggering volume, over 50 billion pieces, it is necessary to read the address on each piece of mail five or more times to route it properly to the addressee. This is a tremendous *seeing* job. Good seeing, important in all industry, is imperative for the expeditious and economical handling of mail and to the welfare of postal employees.

In the past 15 years, mail volume has increased 92 per cent and postal employment has increased about 60 per cent. Even the newer post office buildings, constructed during the last Federal building program in the late thirties and designed to accommodate the expected increase in mail volume for the next 50 years, are badly overcrowded. While improvements in work environment progressed with great strides in private industry during this period, little or no improvement was made in post office quarters. This was in part due to the need for defense spending during the war years and lack of an adequate modernization program in Federal buildings. Faced with the problem of inadequate space, deteriorating working conditions, high employee turnover, and increasing mail volume, it became imperative that action be taken to alleviate the situation.

A Program Is Launched

In 1950, the Congress approved a program and provided the means for making a number of major improvements in the working environment of the principal buildings on Capitol Hill. As an outgrowth of this program, a conference on "The Relation of Environment to Work" was sponsored by the Architect of the Capitol of the United States and the Librarian of Congress. Many recognized leaders in the field of illumination, color, ventilation, sound control, and safety contributed to the program. The conference, held in November 1950, was attended by representatives of the various governmental agencies, business and industry, trade unions, scientific and professional associations, and the press. The conference presented, through discussion and demonstration, the latest methods in producing the most favorable working environment then known. This introduced a new approach to many of the problems facing the postal service. The Post Office Department soon launched its own renovation and improved working environment program in the interest of both economy and employee welfare. The responsibility for conducting further research, to tailor the recommendations of the November conference to the needs of the postal service, was assigned to Mr. L. A. Leighton of the Division of Research. Under his guidance, the Department's program in the field of improved work environment moved into the test installation stage.

The Richmond Experiment

The post office at Richmond, Virginia, was selected for the experimental installation of improved illumination, color and ventilation. This office, having yearly receipts of approximately six million dollars and 1000 employees, is housed in one of the oldest post office buildings. This building, as is true with many erected 40 to 60 years ago, had few of the lighting and ventilating facilities considered essential in modern office buildings. Before renovation began, the working environment was far below recommended practices for the type of work performed.

The work performed consists principally of reading addresses and distributing mail matter into vertical letter distribution cases. These cases, containing the numerous pigeon holes into which the mail is sorted, are approximately six feet high and are aligned in parallel rows occupying the greater part of the workroom area. Each case was equipped with a gooseneck lamp, known as a case light, to provide supplemental illumination. The workroom at Richmond obtained little benefit from natural daylight and depended upon 200-watt filament lamps enclosed in diffusion globes for general lighting. The general light system provided an average of 8 footcandles of illumination with readings as low as 2 footcandles in some areas. The supplemental lighting supplied by case lights provided spot illumination, but had these objectionable features: The lighting intensities varied from

A paper presented at the National Technical Conference of the Illuminating Engineering Society, September 13-17, 1954, Atlantic City, New Jersey. AUTHORS: T. C. Cargill, Jr., Organization and Methods Examiner; E. C. Kautt, Industrial Engineer, Post Office Department, Washington, D. C.

Figure 1 (Below). BEFORE — Inadequate general illumination requiring the use of supplemental lighting over cases resulted in brightness-contrast and glare.

Figure 2 (Left). AFTER — Two-lamp fluorescent units supply about 35 footcandles of well-diffused illumination. Furniture, walls, and ceiling are painted in light reflective colors.

approximately 80 footcandles at the top of the case to 10 footcandles at the lower working levels. The heat radiated from the lamps in close proximity to the employee's head added to his discomfort and fatigue during certain seasons of the year.

In order to provide the best illumination under existing conditions, letter distribution cases had been aligned in relation to the overhead rows of filament lamps. This to some extent improved the unevenness of lighting, but was detrimental to the best utilization of available workroom floor space. The color scheme, poor condition of paint on walls and ceiling, and dark furniture all contributed to the poor illumination in the room.

In studying the Richmond office it became apparent that three principal factors peculiar to large mailing units would affect the functional use of light and color. These were:

(1) Old buildings with columns, high ceilings, large crossbeams, and observation galleries that would interfere with the continuity of the lighting system.
(2) Rows of vertical distribution cases approximately six feet high requiring uniform illumination at various working levels.
(3) The varied operational functions to be performed over a 24-hour period each day, 365 days a year.

Lighting

In the Richmond experiment it was desired to provide at the working level of distribution cases, pouch racks, desks, and in other office areas, a minimum of 35 footcandles of well distributed illumination, without glare from lamps or brightness-contrast from surfaces of furniture and equipment.

To obtain the latest thinking on light and color engineering, recognized leaders in these fields were invited to visit the post office at Richmond and make recommendations for lighting and color conditioning. Their recommendations together with the cooperation of the lighting and painting industries were very helpful in planning the project.

In carrying out the experimental installation, three general types of fluorescent fixtures were used: (1) eight-foot general diffusing fixtures with louvers for two and four T-12 single pin instant start slimline lamps; (2) four-foot general diffusing fixtures with louvers for two and four T-12 40-watt bi-pin base pre-heat lamps; and (3) four-foot direct industrial type fixtures for two T-12 40-watt bi-pin base pre-heat lamps. The four-foot, two- and four-lamp general diffusion fixtures with louvers using T-12 40-watt lamps gave the best results. The preferred fixtures have an open top, directing 40 per cent of the light upward and provide a very even distribution of light throughout the area. The side panels are translucent plastic. Louvers used with this four-foot fixture are of the "egg crate" design having large rectangular open-

Figure 3 (Below). BEFORE — Dark furniture and walls absorb much of the available light. General illumination averaged about 8 footcandles.

Figure 4 (At right). AFTER — Improved lighting permits functional arrangement of furniture with resultant savings in floor space.

ings four inches wide by five and a half inches long. This baffling provides a comfortable eyeshield against the bare lamps at an angle of about 35 degrees and yet allows a maximum of direct illumination at the working level. These fixtures were designed by the General Services Administration and are of the 362 and 364 series.

The industrial type fixture used appeared to have three objectionable features for postal operations lighting: (1) The reflector allowing no upward component of light leaves the upper areas of the room dark; (2) the lack of any opening in the reflector to provide ventilation results in a rapid accumulation of dust and loss of efficiency; and (3) the lack of louvers exposes the bare lamps to sight of employees.

The eight-foot slimline instant start lamps in general diffusion fixtures with louvers were found to produce an excellent lighting installation. However, as the instant starting feature had no particular advantage in this postal application and as cost was an important factor, the 40-watt T-12 preheat lamps were preferable.

Color Selection

Good lighting alone will not provide good seeing and working conditions. Paint of selective colors with proper reflective surfaces and good performance is necessary. The color engineers who joined in the study at Richmond were in agreement as to the colors best suited for the particular needs of postal operations and to complement the fluorescent lighting installation.

Light colors with good reflectance factors were used in painting walls, ceilings, and furniture. Ceilings and beams were painted white; upper walls, light green; and dado, medium green. Workroom furniture was refinished in medium green, with pigeonholes outlined in a light buff. Ledges of letter cases were covered with battleship gray linoleum bound on the edges with an extruded metal strip. Wood floors were covered with light gray linoleum. In clerical offices such as the money order section, claims section, etc., desks were refinished in warm gray with light gray linoleum tops.

Ventilation

To improve ventilation, six 48-inch exhaust fans with automatic opening and closing grills were installed in apertures cut in the wall. These fans are designed for free delivery of 21,500 cubic feet of air per minute. Theoretically, the six fans change the air in the area ventilated in less than five minutes. This ventilation is beneficial in that it reduces the oppressiveness of stale, humid air and removes considerable dust from the workroom.

Cost and Result of the Experiment

The result of the Richmond experiment dollarwise is very significant. The total cost of lighting, painting, and ventilating of the 24,000 square feet

on the first floor amounted to $34,714.65, or a cost of $1.36 per square foot. Using an amortization period of 10 years for fluorescent fixtures and installation costs, and five years for painting and linoleum work and for ventilating fans, the cost prorated per employee of 226 full-time employees benefited is $23.15 a year. It should be noted, however, that in this building the transformers, panel boards, feeders, and branch circuits were adequate to carry the new lighting installation. In other post office buildings it is probable that a considerable amount of rewiring will be required, with a resulting increase in the cost per square foot of a renovation. Based on 1000 units of production per man-hour in 1951 at the time the renovation started, production increased to 1002 units upon completion of renovation in January 1952, and to 1080 units in January 1953. This is an 8 per cent increase over the 1951 base. The increase was accomplished with no pressure on employees. As the average annual salary of post office employees is approximately $4000, it can be seen that an 8 per cent increase in productivity will repay the cost of the improvements in a very short time.

Installations at Other Places

From the experience gained at Richmond, additional experimental lighting installations have been made at post offices at St. Paul, Minnesota; Philadelphia, Pennsylvania, and Rockville, Maryland. While the interior decorating schemes — light reflective colors on walls and furniture — are being used, the mounting height and spacing of fixtures have been changed to provide higher intensities and more flexibility in the arrangement of furniture. The installations at these offices consist of two-lamp four-foot fluorescent luminaires mounted in continuous rows on six- to seven-foot centers, 10 feet above floor level. This mounting and spacing will give approximately 45 footcandles of maintained illumination at the working positions regardless of furniture arrangement.

After the installation of fixtures had been made at the Philadelphia and St. Paul offices, it was found that in large bays the continuous rows of fixtures interfered with vision from observation galleries. It was, therefore, necessary to provide slotted covers permitting an upward component of light over rows of fixtures adjacent to galleries, and to raise other rows to permit vision of the workroom between the rows of fixtures. This was accomplished with little adverse effect on the general lighting level.

General Specifications Developed

On the basis of the experience gained in lighting post offices at Richmond, St. Paul, and Philadelphia, the following general specifications have been developed.

Areas to be lighted in post office workrooms are divided into three categories:

(1) Space utilized for the distribution of letter mail where vertical furniture is used, such as in mailing divisions, city divisions, carrier sections, circular distribution, etc.
(2) Space contiguous to Category 1 where its conversion to the distribution of letter mail may be made at a future date.
(3) Space permanently assigned to the distribution of parcel post, open areas, or office space.

In all categories, fixtures are mounted so as not to interefere with vision from observation galleries. This generally requires mounting heights of 13 to 14 feet. In instances where higher observation galleries are encountered and ceilings are in excess of 20 feet, consideration is given to lower mounting height and the installation of suitable canopies over fixtures.

In Category 1, fixtures are installed in continuous rows. Spacing of rows is based on a standard mounting height of 10 feet, with rows of fixtures 6 feet to 6 feet 6 inches on center. Where fixtures are mounted at heights above 10 feet, the center to center spacing of rows is reduced by three inches for each full foot that the mounting height exceeds 10 feet. Where observation galleries interfere with continuous rows, the continuity of the rows is maintained by mounting fixtures under the galleries in such manner as to provide maximum head room. Our experience indicates that vertical furniture used in post offices reduces the average maintained general illumination from 40 to 50 per cent at the working position.

In Category 2, the installation will be the same as in Category 1, except that every third fixture in each row may be omitted or 50 per cent of the fixtures in alternate rows may be omitted. Spacing and circuiting are provided to permit future installation of omitted fixtures.

In Category 3, installation is determined by the lumen method (*I.E.S. Handbook*, 1952) to provide 35 footcandles of maintained horizontal illumination at working levels.

At service windows, fixtures are mounted over edge of counters 9 feet 6 inches to 10 feet from the floor in continuous rows. Where structural consideration prevents the above installation, fixtures are mounted on wall brackets. Fixtures over service windows are provided with individual switches.

A regularly scheduled system of maintenance has been established. This includes frequent inspection of the lighting system for burnouts and a

thorough washing of lamps and fixtures at least twice a year. In lighting post office workroom areas, the number of hours of burning time that accumulate on lamps in some sections is not uniform. In such instances, since it is not economical to use a group replacement system, spot replacement of lamps is recommended. However, in areas where the burning rate is consistent, a group replacement system is used.

Extension of the Program

Seeing and working conditions in practically all the larger post offices, branches, and stations are considerably below present-day standards. As the modern application of fluorescent lighting and painting is a tool essential for efficient economical operation, the Department is making every effort to extend this modernization program to the larger offices as rapidly as funds permit. This is a large undertaking. The Post Office Department occupies approximately 54 million square feet of floor space in some 3,200 Federal buildings and in addition leases space in 20,891 other buildings. Modernization of these many buildings will take years to accomplish and a considerable expenditure of funds. At this time the initial goal is the modernization of eight million square feet of floor space in the largest buildings within the next three years. As the General Services Administration is entrusted with the repair and maintenance of Federal buildings, the actual work of renovation will come under their jurisdiction. The General Services Administration has been extremely cooperative in working with the Post Office Department in the experimental installations, and their assistance in carrying out the program is appreciated.

It is realized that the limited experiments at Richmond, St. Paul, and Philadelphia have not developed all the elements to produce the highest performance of seeing and working conditions for postal employees. Following further research experience, and as industry continues to improve the efficiency of lamps, fixtures, and color application, it will probably be necessary from time to time to revise basic standards and more specifically define certain elements. However, it has been demonstrated that the basic standards so far developed will provide an improved work environment that will be beneficial to both the employees and the Post Office Department.

Recessed Rectangle Forms Lighting System

Eight continuous rows of 96-inch Standard Cool White lamps, on 430 ma are recessed in the ceiling of Jos Vaillancourt, Inc., pastry and candy store in Quebec, Que., forming a large esthetically pleasing rectangle. The installation provides a level of 75 footcandles after 200 hours in use. Plastic louvers give 45° shielding. Since the cavity is only 5 inches deep, all ballasts are remotely located. With this installation, Romeo Martineau, of La Cie Martineau Electrique, Ltee, Quebec, won second prize in the I.E.S. Quebec Chapter's contest for "My Most Interesting Lighting Job."

Modernizing—

With Light

By R. G. ZIMMERMAN

Before — Popular Library.

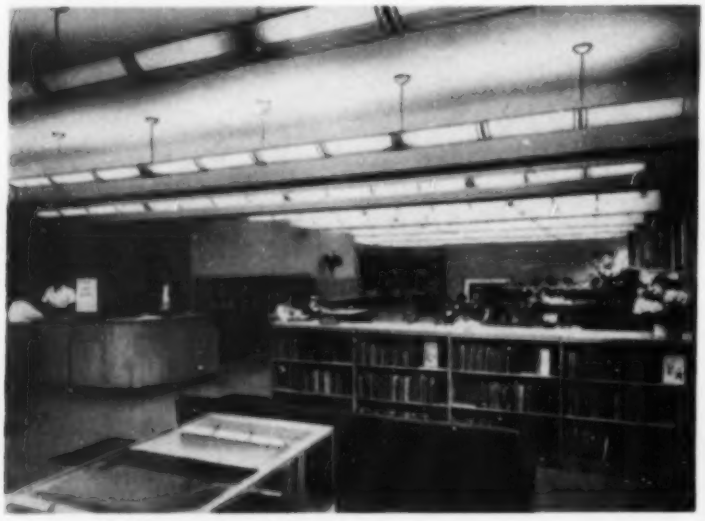
A HISTORY of the lighting systems installed in the Reuben McMillan Free Library in Youngstown, Ohio parallels lighting developments throughout the 50 years since the building was opened. Its lighting has progressed from combination gas and electric, through the frosted bottom carbon lamp, till in the 20's, the "latest" system, totally indirect, was installed as shown in the "before" picture.

Recently the building was again brought up to date, with 1954 concepts of good lighting playing a major part in the modernization. One of the most important innovations in lighting since the 20's is, of course, the inclusion of all surface finishes in the overall lighting plan and careful daylight control; the development, in other words, of a "seeing environment." For the 1954 installation, therefore, brightness ratios in line with I.E.S. recommendations were a planned part of the system. The new flooring material chosen was of a light tan with approximately 25 per cent reflectance; walls were treated with 40 to 60 per cent reflectance paint, and ceilings a flat white of 80 per cent R.F.

AUTHOR: Lighting Specialist, Ohio Edison Company, Youngstown, Ohio.

Central Section

Lighting for the central section, known as the Popular Library, presented some posers. A previous modernization had eliminated the original glass skylight as such, when it was painted over to provide a reflecting surface for the indirect units of the twenties. For the 1954 installation, a luminous



In the three reading rooms, the relighting included special attention to finishes, to meet I.E.S. recommendations on brightness ratios.

ceiling wall to wall mounted at an architectural ledge five feet below the ceiling would have been a natural, except for the wish to retain, and if possible enhance, the five-foot frieze which extended above this ledge around the perimeter of the room. The alternative solution used is no less modern, however. The skylights in the 26-foot ceiling have been replaced with ¾-inch plywood panels, the frames reinforced with two-inch pipe supports. In an interesting pattern between the existing beam structure, surface-mounted fluorescent units with rigid plastic diffusers are installed in 2 ft by 4 ft and 4 ft by 4 ft modules. The plastic diffusers are hinged for easy maintenance. Illumination level, obtained with a cosine-color-corrected meter, is 65 footcandles three feet above the floor after three months' operation, with exceptional comfort and freedom from glare.

After — Popular Library. Old skylights replaced by recessed fluorescent units which provide 65 footcandles three feet above the floor.

Reading Rooms

In the three reading rooms, luminous-indirect two-lamp luminaires using 96T12 slimline lamps provide from 55 to 60 footcandles. Here again, of course, special attention has been given to the finishes of walls, ceiling, floor and furniture, and the visual comfort of the final installation is of a high order. Maintenance is facilitated with a blower-type device.

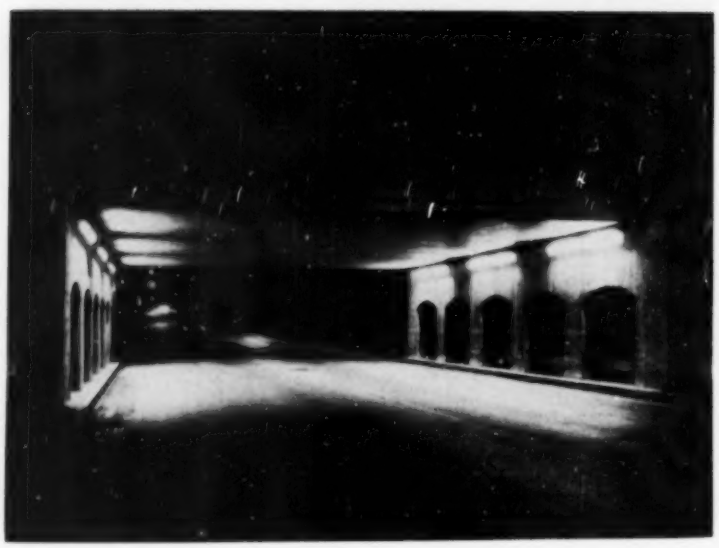
Stack areas of the library have come in for their share of modernization also. Here single lamp louvered fluorescent strips are equipped with a top reflector and a very thin sheet of extruded plastic in all locations where an objectionable side view of the lamp might be experienced.

As a final 1954 touch, four of the front windows are strip-lighted from inside and exterior floodlighting highlights the beauty of the new modern entrance. This has been accomplished simply but effectively with weatherproof brackets and PAR lamps, to which color caps may be attached for seasonal celebrations.

Night view of library exterior shows inviting appearance of strip-lighted windows. Floodlighting enhances new modern entrance-way.

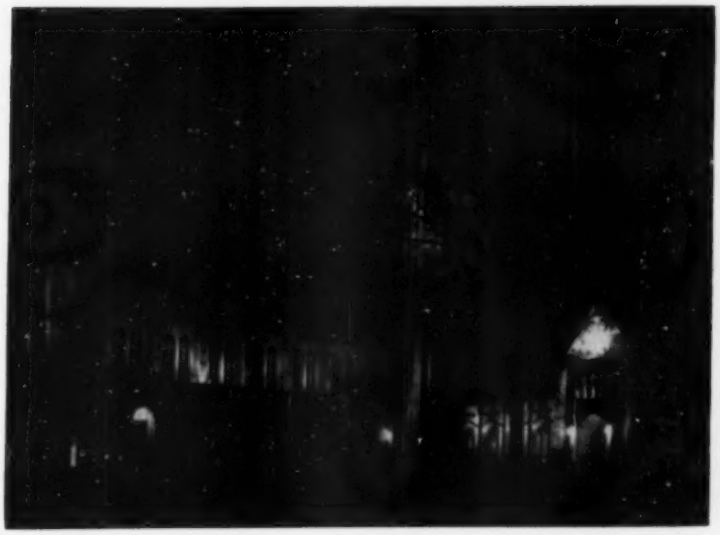
Lighting up the whole outdoors at night would be impractical. But, as these recent installations show, specific areas can be lighted for safe and efficient night operation, buildings can be dramatized, and effective plant protection can be achieved.

A combination of narrow and medium beam 1000- and 1500-watt enclosed floodlamps are mounted on the roof of the building across the street from this department store. Mounted at about fifth storey height, the lamps are concealed by a parapet of the building which serves as a shield and gives a reasonably sharp cut-off at the bottom of the building being floodlighted. The installation was designed for 20 footcandles.



Six open reflectors with specular finish are mounted on each side of the roadway underpass. Each reflector, tilted at 45 degrees, uses a single 72-inch T-8 cool white fluorescent lamp. Illumination is 2 footcandles at center of road and 10 footcandles at five to six feet from side walls.

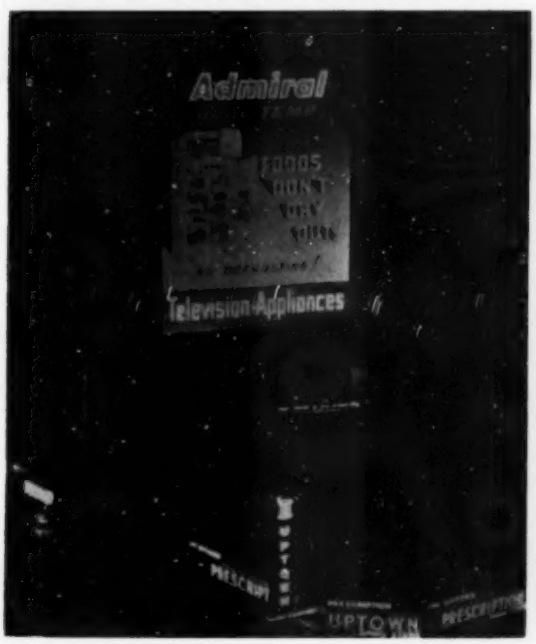
Photos and data courtesy of General Electric Company, Nela Park, Cleveland, Ohio.



Year-round floodlighting of this church is with PAR-38 floodlamps on 15-foot centers to light the walls and PAR-56 floods to light the tower. The stone of the building is in tan color tones, and at Christmas-time some of the floodlamps are covered with yellow and gold roundels. The contrast given by these and uncovered lamps emphasizes a three-dimensional quality.

What's Being Done In Outdoor Lighting

Sign, mounted on the roof of a one-storey building is 45 feet high and about 25 feet wide. Illumination of 30 footcandles is supplied by 34 150-watt PAR-38 spot lamps mounted in two banks about 20 feet from the sign.



Guard finds plant protection easier in this outdoor storage area with the 2 to 5 footcandles provided by 1500-watt medium- and wide-beam floodlights, mounted on 80-foot monotube poles. Each pole has 24 floodlights.

Filament lamps in lens-type fixtures, recessed in the canopy over this railroad station platform, provide an illumination level of approximately 5 footcandles.

Lighting in the individual cages at this baseball batting range is supplied by two PAR-46 and five 500-watt R-40 lamps mounted on 17-foot poles, providing an average of 40 footcandles.

Using towers about 100 feet in height and 1500-watt floodlamps, the installation in this railroad yard speeds up freight through receiving and classification yards.

An Analysis of Twelve Solutions To a Home Lighting Problem

By DR. LAURENCE SCHMECKEBIER
GEORGE DANFORTH
KARL STALEY

BACK in the thirties the Illuminating Engineering Society co-operated in an annual award contest with the Beaux-Arts Institute of Design in New York City. It was a successful activity for many years. In Cleveland for the past five years, three allied groups have worked together with these specific objectives:

a. Co-operation with young designers in three related fields — architecture, industrial design, and illuminating engineering.
b. Focusing of attention of three major professional societies on activities of young prospective members.
c. Focusing of attention on the possible invention of new industrially-producible luminaires.
d. Focusing of attention on light as an artistic design medium.
e. Production of interesting collaborative programs with emphasis on live problems with the possibility of their being carried out.

The contest is called the AIA-IES-SID Student Competition. The letters stand for the American Institute of Architects, the Illuminating Engineering Society, and the Society of Industrial Designers. Six groups actually co-operate: the three societies and three universities which are geographically near each other. The schools are Western Reserve University, Case Institute of Technology, and the Cleveland Institute of Art.

The first year thirty-six Western Reserve University architectural students competed. The second year Case and the Art Institute were invited to form student teams of one architect, one engineer, and one designer.

The subjects so far have been:

1950 Meeting Hall for A.I.A. and I.E.S.
1951 Auditorium, Institute of Art
1952 Restaurant, downtown Cleveland
1953 Small Residence

In this last year twelve architect-designer teams competed. The students were given seven weeks to complete the project. Preceding the classroom criticism, students attended three three-hour technical lecture-and-demonstration sessions. These included a lecture and a movie on fundamentals, lighting terms, and basic concepts. Lectures on lighting design, light sources, and light control followed. The last session was devoted to residence lighting equipment and its application.

The program was a one-story, basementless house 24 feet by 60 feet (7.2 m by 18 m). The rooms were to include a master bedroom, a smaller bedroom and bath, and space to be devoted to cooking, eating, and general activities. The lot was to be 100 feet wide and 150 feet deep (30 m by 45 m). A two-car garage or carport was to be connected to the house.

The requirements included lighting for approach and identification, outdoor living, and lighting outdoors in conjunction with indoor living. Specific activities to be lighted were entertaining, recreation, reading, and others such as food preparation, dining, dressing, laundry, and household maintenance.

Besides the interior perspectives required, there were two in color with two elevations and a structural detail of some important furniture element that could be mass-produced. Featured lighting elements were also required to be shown in perspective color renderings. The jury emphasized creative imagination and sound discriminating judgment.

Analysis of the twelve solutions reveals extensive use of the eleven principal lighting methods in the new I.E.S. "Recommended Practice for Residence Lighting." They include:

1. Portable Luminaires
2. Built-in Luminous Panels
3. Recessed Downlights
4. Valance Lighting
5. Diffused Source for Reading
6. Built-in Bed Lighting

A paper presented at the National Technical Conference of the Illuminating Engineering Society, September 13-17, 1954, Atlantic City, N. J. AUTHORS: Director, Cleveland Institute of Art; Professor of Architecture, Western Reserve University; Application Engineering Dept., General Electric Co., Cleveland, Ohio.

TABLE I.—Analysis of Eleven Principal Lighting Methods Used.

Teams	Portable Luminaires	Built-in Luminous Panels	Recessed Downlights	Valance Lighting	Diffused Source for Reading	Built-in Bed Lighting	Kitchen Ceiling Luminaire	Kitchen — Sink, Range, Counter Lighting	Laundry — Washing, Ironing	Bathroom — Mirror Lighting (Both Sides)	Dining — Suspended Luminaire
1. Kozel-Schwartz	0	x	x	x	x	x	x	x	x	x	x
2. Rimer-Bonner	0	0	x	x	0	x	x	x	x	0	x
3. Van de Velde-Bishop	x	x	x	x	x	x	0	x	x	x	x
4. Srnka-Romelfanger	x	x	x	x	x	x	x	x	x	x	x
5. Burin-Rohrich	0	x	x	x	x	x	x	0	x	0	x
6. Putzier-Sparks	0	x	x	x	0	x	x	0	0	0	x
7. Butzko-Van Tilburg	x	0	x	x	0	x	x	x	x	0	x
8. Howard-Stalzer	x	x	x	x	0	x	x	x	x	x	0
9. Reimel-Archibald	x	0	0	x	x	x	x	x	x	0	x
10. Kouba-Pearse	x	x	x	0	x	x	x	0	x	x	0
11. Kessler-McAndrews	0	x	x	x	0	x	x	0	x	x	x
12. Hawver-Miller (Incomplete)	0	0	0	0	x	0	0	0	0	0	x
Totals	6	8	10	10	7	11	10	7	10	6	10
Approx. Per Cent	50%	60%	90%	90%	60%	92%	90%	60%	90%	50%	90%

7. Kitchen Ceiling Luminaires
8. Kitchen — Sink, Range, Counter Lighting
9. Laundry — Washing, Ironing
10. Bathroom — Mirror Lighting (three planes)
11. Dining — Suspended Luminaire

Their individual use and the percentages in round numbers are given in Table I.

The jury selected a First, Second, and Third winner, then awarded special prizes for Best Architecture, Best Illumination, and Best Interiors. (In the list, the six prize winners are first.) It is interesting to note that the plan that rated best in Architecture (No. 4) used all eleven forms of Table I. It is doubly interesting to know that the Recommended Practice containing this list was published *after* the contest and was therefore not available to the students. As may be seen, the six prize winners used all or practically all of the eleven forms. Only two of the top six used portable lamps, which is probably significant.

A review of the luminaires designed by the students included ten worthy of mention. The first in Fig. 1 is an interesting table lamp, a diffused-glass-and-reflector combination. Perforated brushed brass is used for the reflector. The tangent circle indicates a diffused-glass plate underneath. A swivel joint permits pointing it in several directions. Lamps of this type are shown at chests of drawers and a vanity table. As far as its use in the vanity table is concerned, bouncing the light off the table top is better than having it, say, reflect from a wall mirror, but it is still not the most effective method. Incidentally, the designers did not show a switch in the sketch. Their plan may have been to build the switches into the furniture, however.

In the drawing rated "Best Interiors" by the jury, there is a thoroughly contemporary dining-room dome (Fig. 2A). The students described it as follows: "Hanging light fixture for over dining table. Lamps include 12-inch and 8½-inch circular tubes and 100-watt spot in center, switched individually. The fixture can be extended by pulling along track fastened to joists. The cord is weighted at intervals by pullied counter-weights. The fixture can be adjusted from one to fifteen feet from center of dining area."

The luminaire itself consists of a dome of white

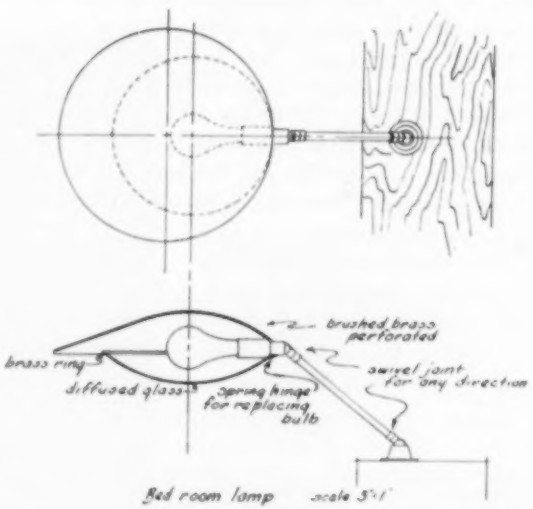
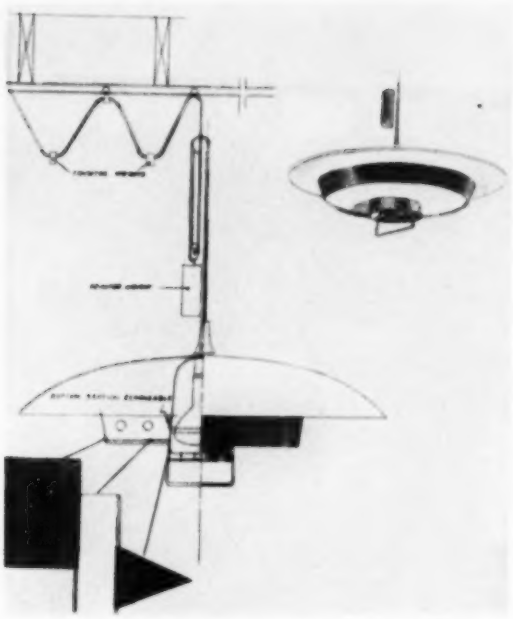


Figure 1. Table lamp.



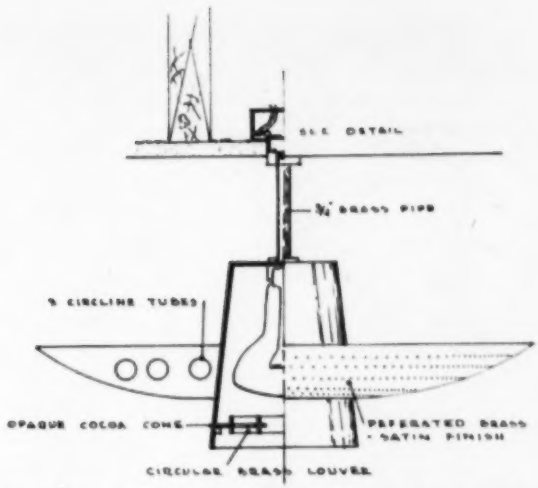
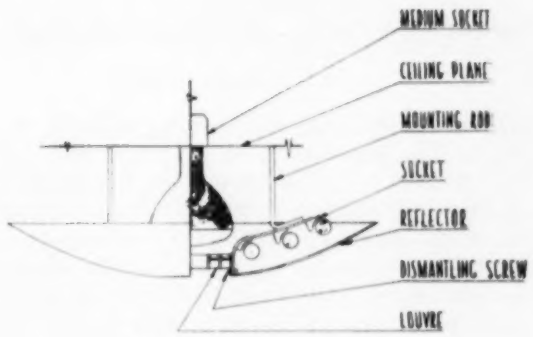


Figure 2A (left); 2B (above); 2C (below) Dining-room luminaires.



glass with a slightly tilted shield of perforated metal. Underneath is a flat plate of white glass, and in the center a three-ring louver. The center illuminant is a reflector-type bulb. The fluorescent tubes supply desirable upward light through the dome and they furnish diffuse light downward.

For dining in the usual spaces provided, a 75-watt downlight might well suffice for the center component. The additional light provided by the two tubular sources would serve other purposes, of course — higher footcandle levels for studying and other close eye-work.

As shown in Fig. 2B, another dining-room luminaire contains concentric circular fluorescent lamps — three of them — and a satin-finish perforated-brass shell. A feature is an opaque cocoa-colored cone with brass ring-louvers. The ballast appears to be concealed in the ceiling above. There seems to be no way shown to get at them, however, such as an access door. This should have been included, of course, and for code reasons, the usual metal box should have been indicated. Here again is an exemplary concept with too much light. A 150-watt reflector bulb as shown, for downlighting might be unbearable; a 75-watt with good louvering would suffice for the table. Also a single 40-watt tube would be generally adequate for upward lighting purposes with the others switched on for sewing, studying, and similar auxiliary dining-room activities. Similar comments apply to Fig. 2C which has a slotted design in the reflector.

Fig. 3 is taken from the third-prize rendu showing a section view of the kitchen with the lady of the house wearing an early-morning expression. The luminaires on both walls produce cross-lighting extending the length of the kitchen and on into the utility room. The units are double-tube and covered, to be "manufactured in four-foot lengths." The legend further states that "the light from the fluorescent tubes would come over both shoulders of a person working at the counter, therefore eliminating any shadows."

The same house plan included two natural-lighting methods — a clerestory in the middle of the

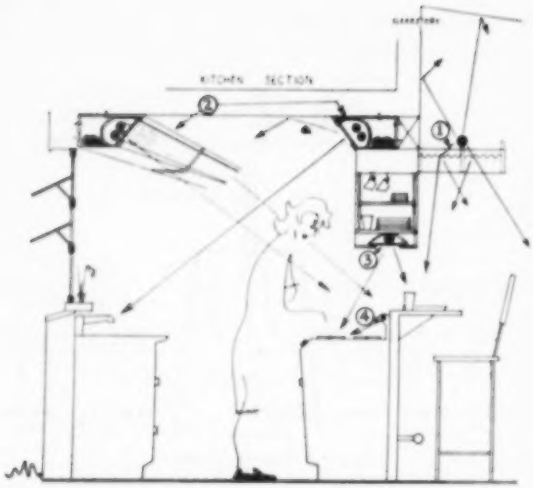


Figure 3. (above) Kitchen tilted-troffer, under-cabinet, and lattice luminaires.

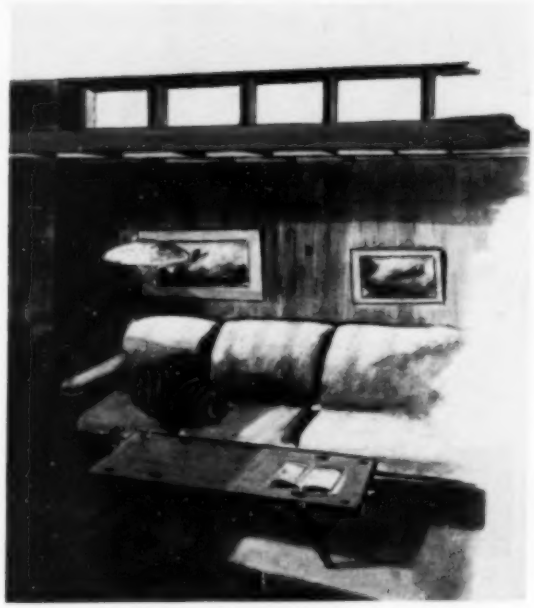


Figure 4. (right) Horizontal-lattice adjacent to clerestory.

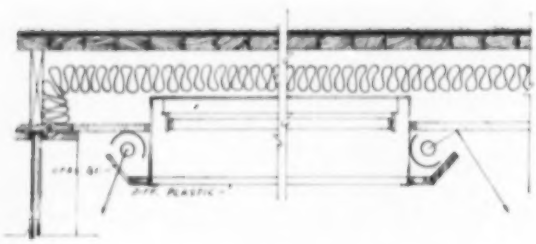
roof and a trellis in the overhang near the entrance. The clerestory is in a lighting sense extended inside the house for after-dark lighting in an exemplary fashion. It is modestly described by the designers as "egg-crate lighting which extends into living room and vestibule; one-foot squares separated by rippled plastic; a row of fluorescent tubes is the lighting source." (This was, in the opinion of many observers, the most outstanding application in the contest, although a double row of lamps is obviously necessary.) The horizontal lattice actually progresses through the living and dining areas. The vertical rectangles (Fig. 4) are the lights of the clerestory.

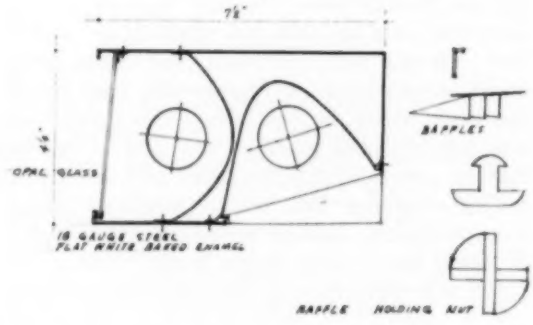
In Fig. 5 is shown a semi-recessed general-lighting luminaire from the "Best Illumination" home design. The luminaire is approximately 6 feet by 26 feet (2 m by 7.8 m) and contains two outer rows of fluorescent lamps. The row on the room side is shielded by an opaque reflector. The other side — the wall side — similarly is shielded by white glass. The center part, a large diffuse downlight in effect, is lighted by 12 tubes spaced side by side on about 2-foot (60 cm) centers. Switch control produces several lighting steps. (Circular lamps in this section might have been a more conservative choice.)

In this same house an interesting mural is located in one corner of the living space, near the TV set. The mural is lighted by a simple surface-mounted "dual" troffer. One side is glazed in white glass

Figure 5. (below) General-lighting luminaire-triple troffer.

Figure 6. (right) Dual troffer section.





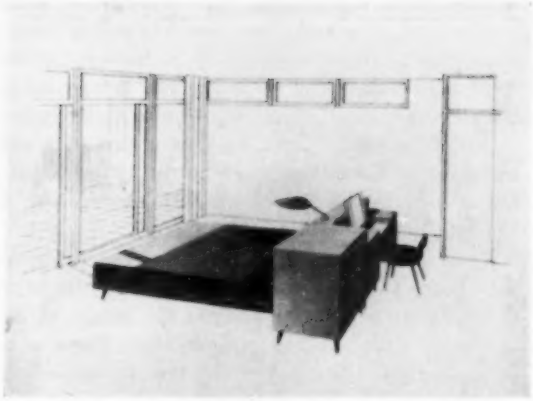


Figure 7. Furniture group — bed—dressing table.

and the other shielded by triangular metal baffles (Fig. 6). The surface seems too bright on the room side, as it is drawn. A perforated-metal screen over the glass might reduce the brightness to a more tolerable level.

In the illustration marked Fig. 7, a combination furniture group has earmarks of excellence. The framed mirror appears to be illumined. Other light in the room is presumed to soften the more concentrated lighting thus produced. It is to be especially noticed that in the majority of the solutions in the contest, this point of good lighting design — combined effects of general and localized lighting — was almost never neglected.

The yard luminaire of Fig. 8 contains two 150-watt filament lamps concealed in a cylinder of glass. The top is a free form shielded by an aluminum cover and side shields two feet (0.6 m) high. These confine the light to about 180-degrees. The louvers are marked "for ventilation," but they give some light downward.

The outdoor lighting post of Fig. 9 specifies 150-watt thick-glass reflector lamps and 100-watt conventional filament lamps, three each. The spun-metal hood over the top measures 3 feet (1 m) in diameter and a diffuse plastic shield is shown underneath. One of these posts is placed in the middle of a very small square of grass. This design comes from the drawing rated "Best in Illumination" and in it there were some evidences of excess lumens. For instance, the exterior is lighted by more than two dozen floodlights, many may be more than necessary for "lighting outdoors in conjunction with indoor living."

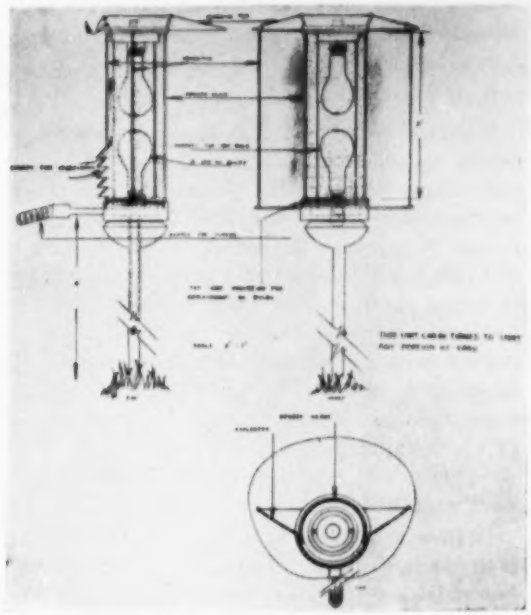


Figure 8. Yard luminaire.

The delineation of room interiors varied considerably in the drawings, as might be expected. Fig.

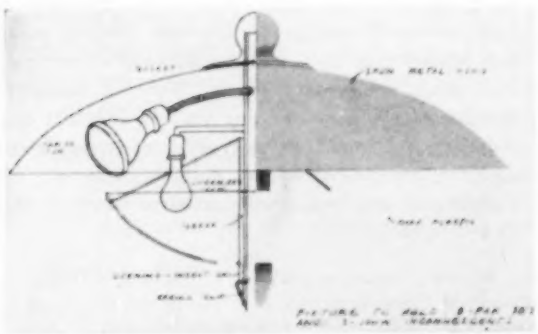


Figure 9. Outdoor lighting post.

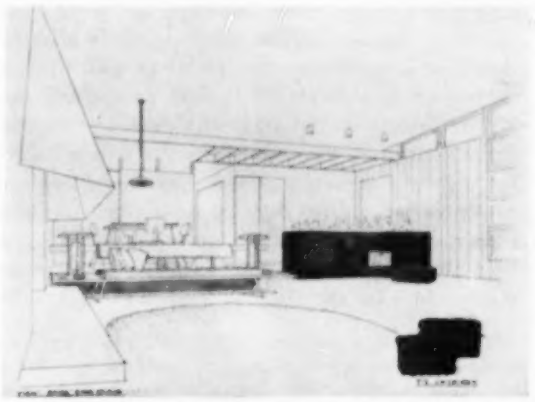


Figure 10. Typical perspective of prize-winning interior.

10 shows a sample perspective of one of the better delineated interiors (second prize).

(The display of the twelve sets of drawings was a part of the Conference presentation.)

From the standpoint of professional education in design, collaborative competitions among Cleveland institutions have developed into a major though informal part of our program. The basic concept is that of exposing the student to the daily give-and-take requirements of the profession as it exists in actual practice. The advantage is that this exposure takes place early in his career while the student is still concerned with fundamentals. By competitive cooperation, he acquires an intuitive understanding of the methods and approaches used by the architect, the engineer, and other professional men with whom he will eventually have to work when he gets into the business world.

In those arts where the integration of design and craftsmanship are fundamental — architecture and industrial design — new solutions have had to be developed. In our experience this method of collaboration has had phenomenal success in associat- the essentials of general education with those of the craftsman; one learns the language and working vocabulary of his professional co-worker through meaningful and functional associations. One learns the art of give-and-take as a part of the working process long before he faces the cold and compelling facts of professional practice. While maintaining the detachment and intellectual freedom of the student in his cloistered training period, he enjoys the constructive criticism and companionship of his professional superiors — a combination which the old apprentice system in studio or office seldom permitted.

It is no new thought that industry has a vital interest not only in educational institutions as such but also in the students themselves. The first and obvious reason is that here is the reservoir of manpower and talent upon which the future of every industry depends. More subtle is the realization that here is a reservoir of new ideas which can be uncovered and developed or left to stagnate and die, depending on the point of view held by industry. Institutions have always served as the collecting points for creative ideas both historical and contemporary. Btu it is through the students, young, fresh, unlimited in their enthusiasm and undaunted by their failures that new ideas are uncovered. In an age of revolution and rapid change, when a building, once destined to stand for the ages, is now declared obsolete in less than a generation's time, history seems to have exhausted itself and science appears to be the inexhaustible. We are indeed in the process of building an entirely new civilization which itself is a part of a new history with science and art not at opposite poles but essentially unified along with engineering as the determining factor in the change.

From an architectural education viewpoint, an extremely wholesome and inspiring attitude of design in terms of function and the nature of materials prevailed in the competition. There is no surrender to historical style nor to superficial mannerisms in decoration. However, there does seem to be a curious form of modern eclecticism. There is frequent evidence of too much study of the work of contemporary designers and architects, inspiring though they may be. On the other hand, the demand for new designs in lighting fixtures produced a number of commendable inventions and ideas capable of mass production.

With the broader scope involved in the teaching policies of both the School of Architecture and the Institute of Art, it would seem that the more purely aesthetic and non-utilitarian products of the contemporary artist would find a place in such interior designs. The decorative integration of works by the contemporary painter and sculptor seems to be a problem yet to be solved in the minds of our younger designers.

From the standpoint of "progress in the dissemination of information on illumination," it is felt that the coalescence of student talents in the three branches of learning has been extremely successful. Each year's activities seem to show expanding possibilities. This year's program was a service center (gas station and restaurant) on the new Ohio Turnpike. The Turnpike Commission invited the winning teams to come to Columbus to present their designs. Another sidelight — mention of the activity at the Stockholm meeting of the International Commission on Illumination (C.I.E.) by U. S delegate Professor Russell C. Putnam of Case, aroused considerable interest. British members stated that they had a similar plan in mind and would soon carry it out. From a collective standpoint, we may one day make a cultural contribution to world values. The need for more architect-engineer-designer collaboration in the building of new homes seems evident in every part of the world.

INSTALLATION IN RESIDENCE OF MR. AND MRS. CHARLES CORGE, SHORT HILLS, NEW JERSEY.

Functional Decorative Lighting In a Modern Foyer

LIGHTING OBJECTIVE: (1) To furnish general illumination in the foyer, (2) to provide a decorative treatment that will present an attractive appearance as viewed from the living room, (3) to integrate the lighting equipment into the architectural design of the room.

GENERAL INFORMATION: The foyer is 15'6" x 5'1" with an 8' ceiling. Two walls are painted gray, 50 per cent reflectance, and two walls paneled with "grayed" Philippine mahogany, 35 per cent reflectance. The two end walls within the recess containing a tier of glass shelves are painted a light cherry red. The wall-to-wall carpeting is light gray, 50 per cent reflectance and the ceiling is white, 80 per cent.

INSTALLATION: A ceiling-suspended luminaire, constructed of "grayed" Philippine mahogany, conceals a single row of two 40-watt T-12 fluorescent lamps. Accent lighting for the art objects on the tier of glass shelves is furnished by a channel equipped with two 40-watt T12 fluorescent lamps, side by side. Deluxe warm white lamps are used in both locations. (Fluorescent channel, #8140 installed in the ceiling luminaire, and #8240 installed in the recessed glass shelf section, is manufactured by Leader Division, Benjamin Electric Manufacturing Company, Chicago, Ill.)

(over)

A.I.A. File No. 31

Figure 2. View from living room.

The totally indirect ceiling luminaire produces an average of 7 footcandles of general illumination. With both the ceiling luminaire and the decorative shelf lighting in operation the following brightness relationships exist (readings taken from standing eyelevel in living room, 4 feet from foyer opening):

Brightest area on ceiling above luminaire	345 ft-L
Back wall of recessed section	
near top	64 ft-L
middle section	22 ft-L
lower section	9 ft-L
Wall on either side of recessed shelves, 5' above floor	6 ft-L

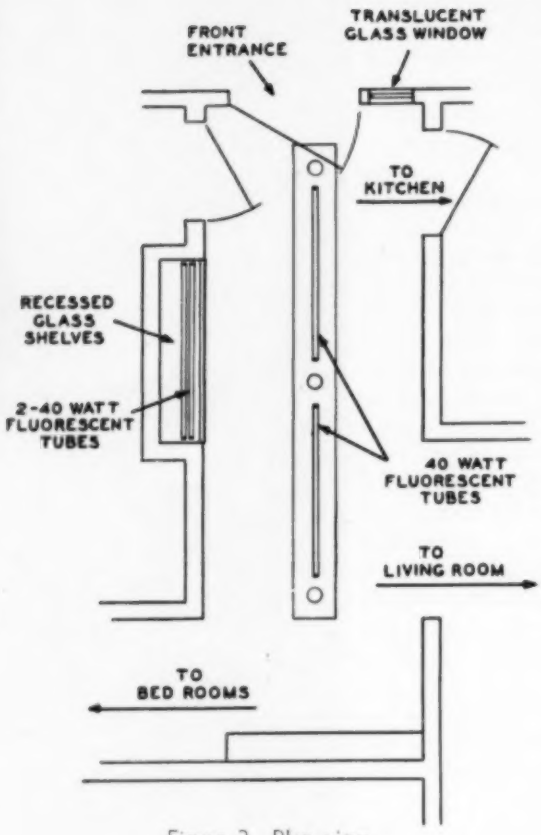


Figure 3. Plan view.

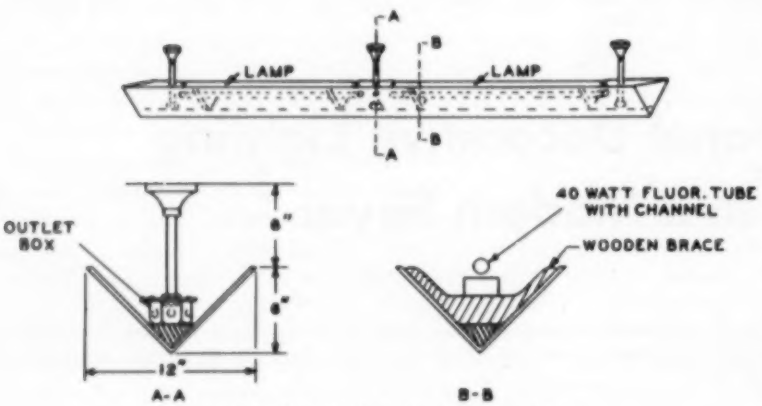


Figure 4. Detail of suspended luminaire.

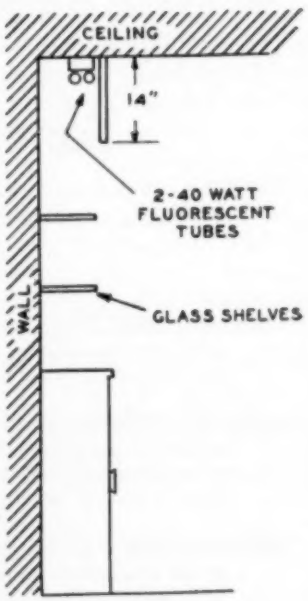


Figure 5. Detail of niche lighting.

Lighting designer: Jack Kilpatrick, New York City; builder: Leonard Giaimo, Newark, N. J.

Lighting data submitted by Edith L. Buchholtz, Lamp Division, Westinghouse Electric Corporation, Bloomfield, New Jersey, as an illustration of good lighting practice and to aid in the design of similar installations.

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Fusing of Ballasts for Fluorescent Lamps

By E. C. SCHORR

EXPERIENCE has shown that under certain unusual conditions it is possible for a ballast failure to be accompanied by physical damage to the fluorescent lamp fixture. As a result, many questions arise about fusing and fuse ratings with regard to fluorescent fixtures and ballasts.

During normal operation the losses in the ballast generate heat which in turn is effectively transmitted by the potting compound to the ballast case where it is dissipated to the surrounding air by conduction, convection and radiation.

Practical requirements in the design of the ballast unit necessitate use of such organic materials as paper, asphalt, varnish, and so forth. Even though ballasts are designed with adequate safety factor to withstand temperatures in excess of the allowed maximum value, deterioration of the materials occurs and the life of the ballast is seriously shortened under such operating conditions.

Of the failures involving fixture damage investigated to date, all circuits involved have been of the lead-lag type although other types may be subjected to similar failures. Almost without exception, the principal cause of failure and occasional damage to the fixture has been excessive temperature.

A lead-lag circuit consists of an auto-transformer to convert the line voltage to the required voltage for satisfactory lamp starting, a series reactor for one lamp, and a combination of a series reactor and capacitor for the other lamp.

The series reactor circuit produces a load of about 50 per cent lagging power factor and the series reactor-capacitor combination produces a load of approximately 50 per cent leading power factor. These two loads are combined in the autotransformer to form approximately a 100 per cent or unity power factor load.

The series capacitor in the leading power-factor branch is a small, relatively low-voltage, power capacitor and consists of thin sheets of aluminum foil separated by several thicknesses of very thin high-dielectric paper. The capacitors are designed to give long life, providing the temperature does not exceed 70°C.

AUTHOR: Ballast Department, General Electric Co., Danville, Ill.

If a capacitor short circuit failure occurs, the normal 50 per cent leading power-factor load becomes about 50 per cent lagging, and this, added to the normally lagging load produced by the other lamp, greatly overloads and auto-transformer windings. The line current increases, for example, from a normal value of about .85 ampere to approximately two amperes in a two-lamp, 40-watt, 118-volt ballast.

Similar overloads can also result from overheating the insulation in the coils. If the ballast is permitted to operate for an extended period with such an overload, the insulation in the autotransformer coil and in the vicinity of the coil becomes very hot and carborinzation takes place. The result is a greatly reduced resistance to ground.

Since one side of the line and the ballast case are generally grounded, a reduction in resistance may permit an arc to be established between the coil, or the ungrounded line lead, and the ballast case. The intensity of this arc is limited only by the line resistance and may, in an extreme case, melt a hole in the ballast case or cause the ungrounded lead to be fused off where it leaves the case.

During the advanced stages of carbonization there is the possibility that volatile vapors may be given off by the organic materials, and if the fixture will not permit these vapors to dissipate into the air, they may be ignited if a power arc is established.

Branch circuit protective devices may or may not operate when the ballast becomes defective because the increase in line current of one unit at a lagging power factor of less than 50 per cent adds very little to the overall current. The establishing of the arc, however, should cause protective devices to clear the circuit. In several instances of failure the branch circuit protective devices operated but were closed again before the circuit had been investigated for a fault and this reclosing provided the necessary voltage surge to produce an arc.

The chances of physical damage accompanying such failure as described above are remote even though the unit has become defective as described. The autotransformer may open circuit in a relatively short time after the defect develops, and this

automatically removes the ballast from the line. If sufficient fixture ventilation is present, the vapors given off by the organic materials may pass into the air, and even should an arc be established, no ignition takes place.

Several preventive measures are recommended to reduce even this remote possibility of ballast failure and accompanying risk of physical damage:

A. Of first importance is that the ballasts operate in an ambient which will not cause overheating of the windings and the capacitor. To reduce the compartment temperature, the following is recommended:
   1. Ventilate the fixture ballast compartment.
   2. If the lamps are located directly under the ballast compartment, some means should be provided to ventilate the lamp compartment so that less heat reaches the ballast compartment.
   3. The ballast should be mounted directly against a cool surface of the fixture. Unless absolutely necessary, spacers under the mounting feet should not be used.
   4. The use of heat conducting "radiators" which bear on the ballast case will many times result in lower temperatures.
   5. In some cases, removing the ballast to a cooler location outside the fixture itself may give the necessary reduction in operating temperature.
   6. Painting the inside of the fixture ballast compartment with a non-metallic paint of any color will increase the effective radiation and lower ambient temperature.

B. A fixture should be connected to a circuit delivering rated voltage and frequency.

C. The use of a no-blink type starter is highly desirable since it removes deactivated lamps from the circuit, which in turn reduces ballast heating.

A very effective way of providing protection against rare cases of fixture damage resulting from ballast failure is to use a fuse in series with one or both of the line leads to each ballast. These fuses should be of such size that they will insure against false failure and still protect the ballast.

Many tests have been performed in order to determine the following fuse ratings for ballasts. However, it must be noted they are suggestions only because no one can assume responsibility for factors not within his control, such as ambient temperature and improper fuse action due to fuse quality.

Single & dual 4-, 6-, 8-, 14-, 15- & 20-watt	1.0 Amp
Single & dual 30- & 40-watt, including rapid-start	1.6 "
Three-lamp 40-watt	2.0 "
Single & dual 90- and 100-watt	3.0 "
Trigger start (all ratings)	2.0 "
Single Slimline	
All 120 ma	1.0 "
All other	1.6 "
Two-lamp Slimline	
All 120 ma	1.6 "
All other	3.0 "

The above fuse ratings are based upon 110-125 volt operation. For 208-265 volt operation, use fuses rated at one-half the above ratings.

In order to cover the wide range of normal operating conditions, it should be kept in mind that the difference in primary currents between these conditions and some types of failure would be very small or might even overlap. This fact coupled with the large increments between standard fuse ratings makes it impractical to fuse properly ballasts for every possible type of failure.

The suggested values given above should result in circuit clearance before dangerous magnitudes of currents occur. When investigating lighting installations for trouble, non-rupture of the fuse cannot be considered as positive proof that ballast failure has not occurred.

An additional suggestion for the prevention of unnecessary destruction of fuses is that slow-acting or delayed-action type fuses be used. These are less likely to be affected by high starting currents or line surges.

It is felt that fuses with the listed ratings will clear a ballast from the line when fault current approaches such a magnitude as to cause a possibility of ignition of gases in the ballast and resultant damage to the fixture. Most desirable is that all fuses be mounted inside the ballast compartment. In this way replacement of a fuse requires opening the fixture and the ballast can readily be examined before a new fuse is inserted.

Since it is not feasible to build ballasts with self-protective features, and since the responsibility for ventilation and application rests with the fixture manufacturer, it is important that these factors be considered.

Any publication or guarantee on ballasts must stress the importance of ballast temperature control. Proper dissipation of heat is of utmost importance and to assure correct temperatures for long ballast life. Ventilation can provide an escape for the products of combustion in case of a ballast burnout. In special types of fixtures where ventilation is not possible and cooling by radiation and conduction is perhaps inadequate, it is of primary importance that the fixture be protected by fusing each individual ballast.

A Practical Investigation On Discomfort Glare

Reported by J. C. LOWSON, A. DRESLER and S. HOLMAN

Summary and analysis of tests carried out by members of the Illuminating Engineering Society of Australia.

THE Standards Association of Australia is now revising its Artificial Lighting Code, incorporating the amendments issued since the Code was first published in 1942, and bringing it up to date in other respects.

During the last few years a great deal of research has been going on throughout the world on the factors which influence direct and reflected glare. To ensure that the revised S.A.A. Code will give the most precise and easily interpreted guidance on the subject that the present state of knowledge permits, the published data have been carefully examined and, in addition, some independent practical field tests have been carried out by the Illuminating Engineering Society of Australia (N.S.W.).

These tests are only one isolated section of a study on ways and means of controlling glare, a study which will be reported in full after the revised code has been issued; but in view of the current widespread interest in glare appraisal, the Illuminating Engineering Society (Australia) suggested that it would be worthwhile publishing a brief account of the practical tests without further delay, especially as this piece of field research is complete and self-contained.

Purpose of the Investigation

Before embarking on a description of the tests, it may be helpful to give a short explanation of why they were undertaken. A simple analogy may help to make this clear.

The lighting engineer has little difficulty in designing installations which will produce a satisfactory illumination level for he is dealing with a precise numerical unit — the footcandle. Imagine how much more difficult his task would be if this convenient yardstick (and all the design data, footcandle meters, etc., that go with it) were suddenly taken away. The engineer would then have to fall back on vague generalizations such as "fluorescent lamps are more efficient than incandescent lamps," "rooms with dark walls and ceilings utilize light less efficiently than rooms painted out in light colours," or "direct lighting units are more efficient than totally indirect units," and so on. Under these circumstances, lighting design would become a matter of guesswork and rule-of-thumb built up on laboriously acquired experience, the only clue to the satisfactoriness of the result being whether it "looks all right" to an experienced lighting engineer. In fact, the designer would be in very much the same situation as he is now when tackling the problem of glare.

The designer has plenty of *general* information about glare. For instance, he knows that "bare lamps are more glaring than diffusing fittings," "fittings seen against a dark background are more likely to be glaring than those seen against a light one," or diffusing fittings hung low down are usually more glaring than those mounted high up." But he has no numerical yardstick with which to measure the relative influence of these things. Guesswork, rule-of-thumb and experience are his only guide.

That is how the matter stands at present; but lighting research workers throughout the world are striving to find a satisfactory numerical yardstick for glare, a yardstick which will enable the designer to avoid excessive glare as easily as he now avoids too low a level of illumination.

This goal has not yet been reached; but considerable progress has been made, although no single method has yet gained universal acceptance. However, one method which has attracted considerable interest is the "Glare Factor" system developed by Ward Harrison and Phelps Meaker.[1] This system

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1. See paper "Further Data on Glare Ratings" by Ward Harrison and Phelps Meaker, ILLUMINATING ENGINEERING, Vol. XLIV, pp. 153-179 (1947).

expresses the relative degree of comfort or discomfort in terms of an arbitrary numerical "glare factor" calculated by a semi-empirical formula which takes account of various relevant factors including the number, size and brightness of the fittings, their mounting height, and the general illumination level. They have, moreover, developed a simple set of tables whereby the approximate Glare Factor of an installation can be determined while it is still at the drawing board stage.

But before a system of this kind can be put to practical use, the numerical scale must be "calibrated" in terms of the observed degree of comfort or discomfort in actual installations. Harrison and Meaker have already carried out such a calibration, organizing a group of experienced lighting engineers to view a series of actual installations. The averaged opinions of this group were then compared with the calculated Glare Factors of the installations, and a calibration obtained.

The results of these tests are available, but it does not necessarily follow that the American calibration would be acceptable in other countries; in fact, there has been some criticism of it in international lighting circles. When the Glare Factor system was being studied in connection with the current review of the S.A.A. Code, it was considered essential to carry out some practical tests under Australian conditions, to check the validity of the Glare Factor concept, and to calibrate the Glare Factor scale in terms of a "comfort scale" likely to be acceptable to the Australian lighting profession.

Organization of Tests

This test work was done by a group of lighting engineers drawn from the Illuminating Engineering Society of Australia (N.S.W.) and organized by S. Holman.[2] The group visited a series of selected installations in Sydney, appraising the degree of "comfort" in each case. Glare Factors were not calculated until all these observations were complete and the results collected, so there was no possibility that the observers' opinions might be influenced by these data.

Various types of incandescent and fluorescent installations were covered by the tests and appraisals were made at twelve points altogether. In some cases two or three of these test points were located in the same room at different distances from the far wall. This was to ensure that the tests would be scattered about the significant range of "comfort" in which we were interested.

2. In addition to Mr. Holman, the following people took part: Messrs. G. C. Brown, H. Chadwick, G. Y. Falk, H. G. Fallon, E. S. Glover, L. A. Hayes, I. Holman, L. S. Hyatt, J. S. Johnson, J. Knight, H. McCourt, S. R. Munt, and W. I. Stewart.

The incandescent installations viewed in six of the twelve tests employed diffusing opal glass enclosing units of various sizes and wattages. The fluorescent units viewed in four of the tests consisted of two flat diffusing panels arranged in "V" formation, enclosing two 4-ft 40-watt lamps. The fluorescent fittings viewed in the last two tests were shallow rectangular shaped units with diffusing bottom and sides, containing a flat bank of four 4-ft lamps. In each case the subsequent Glare Factor calculations were based on the maximum brightness of the fittings as viewed from an angle of about 45° to the downward vertical.

The lighting engineers who took part in these tests had an average experience in their profession of 14 years. The fourteen observers were asked to mark on their individual score cards whether they considered the installation under review to be Comfortable, Just Comfortable, Slightly Uncomfortable, Very Uncomfortable, or halfway between any two of these. No attempt was made to educate the members of the group towards a common idea of what was or was not comfortable. It was left entirely to their individual discretion, for in this way it was hoped to arrive at a "comfort scale," acceptable to the Australian lighting profession, which could be calibrated in terms of H.-M. Glare Factors.

Elaborate precautions were taken to guard the observers against visual fatigue and against things which might influence their judgment. Some of these precautions were as follows. The fourteen observers were split into three approximately equal groups. Each group visited six test-points only, and when there were two or more test-points in a single room only one test-point was appraised by the observers in any one group. The tests were got through as quickly as possible (the whole series took only two hours) but observers were not allowed to make their estimates until they had been seated at least five minutes, and they divided this time between reading, writing, and looking straight ahead.

Analysis of Results

As might be expected, some groups proved more consistent than others, and there were individual appraisals which differed greatly from the rest. But in analysing the results, every individual appraisal has been included and given equal weight; the results are presented in Table I.

To simplify this presentation, the average opinion of each group of four to five observers was determined by the following method. An arbitrary numerical comfort scale was applied to the score

TABLE I.—Results of Appraisals.

Test Number	Type of Fitting*	Observer Group	DISTRIBUTION OF VOTES (Each x represents one observer's vote)						Average of Group	H.-M. Glare Factor
			Comfortable 1.0	1.5	Just Comfortable 2.0	2.5	Slightly Uncomfortable 3.0	4.0	Very Uncomfortable 5.0	
1	A	I II		x	x	x	xx xx	xx x		3.2 2.8	60
2	A	I II	x	x x	xxx xx		x	x		2.1 2.1	30
3	B	I		xxxx	x					1.6	32
4	B	II		x	xx		xx			2.3	62
5	B	III				x	xxx			2.9	82
6	C	I III	xxxx xx	x	x		x			1.1 1.75	17
7	A	I III	x	x x	x	xx	x x	x		2.3 2.4	22
8	A	I	xx	xx			x			1.6	25
9	A	II			x	xxx	x			2.5	42
10	A	III	xx		x				x	2.75	76
11	D	II III	xx	x x	xx	xx	x			1.7 2.1	28
12	E	II III	x xxx	xx	xx x					1.6 1.25	16

*Type A—Incandescent diffusing. Type B—V-shaped fluorescent—viewed crosswise. Type C—Ditto, viewed lengthwise. Type D—Flat rectangular fluorescent—viewed crosswise. Type E—Ditto, viewed lengthwise.

cards. On this scale a vote of "Comfortable" rated 1; "Just Comfortable" 2; "Slightly Uncomfortable" 3; and "Very Uncomfortable" 5. Intermediate points rated 1.5, 2.5, and 4. "Very Uncomfortable" votes were rated 5 instead of 4, because the step between "Slightly Uncomfortable" and "Very Uncomfortable" seemed to be considerably larger than any of the others. Hence, the intermediate step was assigned a value of 4 which was tentatively named "Definitely Uncomfortable." This is an arbitrary method but, under the circumstances, it seemed a sufficiently accurate way of assigning each test-point a place on the subjective comfort scale.

An analysis of the votes, and the averaged opinions of each group, are tabulated below, together with the H.-M. Glare Factor calculated for each test-point. Fig. 1 gives an overall picture of the situation. Here the calculated Glare Factor is plotted against the observed degree of comfort, the averaged opinion of each group of four to five observers being shown as a separated small circle. In some cases two groups observed the same installation and where this has happened the individual circles are each marked with a cross and the pair is linked with a dotted line. This method gives some indication of the variation between groups, while ensuring that each spot (representing four to five observers) has about the same weight.

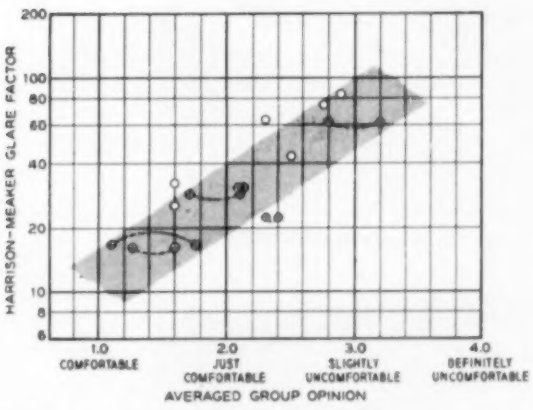


Figure 1. Sydney Glare Appraisal Tests. Calculated Glare Factor is plotted against the observed degree of comfort the averaged opinion of each group of observers being shown as a separated small circle.

Conclusions

Subjective appraisals of an intangible thing like "degree of discomfort" are always difficult to make, and to get precise results in an investigation of this kind would have required a programme of tests and a body of observers impracticably large under the circumstances.

However, in spite of the unavoidably small number of installations viewed and the limited number of observers available, the work has proved

well worth while. In spite of the inevitable scatter of the points, it is possible to confine most of them within a definite band. Actually, the spread can be assessed mathematically by calculating the correlation coefficient. This would be zero if the points were scattered at random, and 100 per cent if they lay on a single straight line. In point of fact, they group so well that the correlation coefficient is 80 per cent, which is an unexpectedly good result.

It is interesting to note that, although the original Harrison-Meaker calibration was criticized as giving too low Glare Factors, their figures (Comfortable 6; Almost Comfortable 20; Slightly Uncomfortable 60; and Very Uncomfortable 200) are not so very far below those indicated by the present tests.

The tests seem to be a clear confirmation of the usefulness of the Glare Factor tables as a means of predicting and thereby limiting direct glare while the installation is still at the drawing-board stage. Moreover, the chart provides a useful indication of the connection between Glare Factors and the average opinion of a representative cross section of the Australian lighting profession.

Re-Lighting Design for High-Ceilinged Banking Area

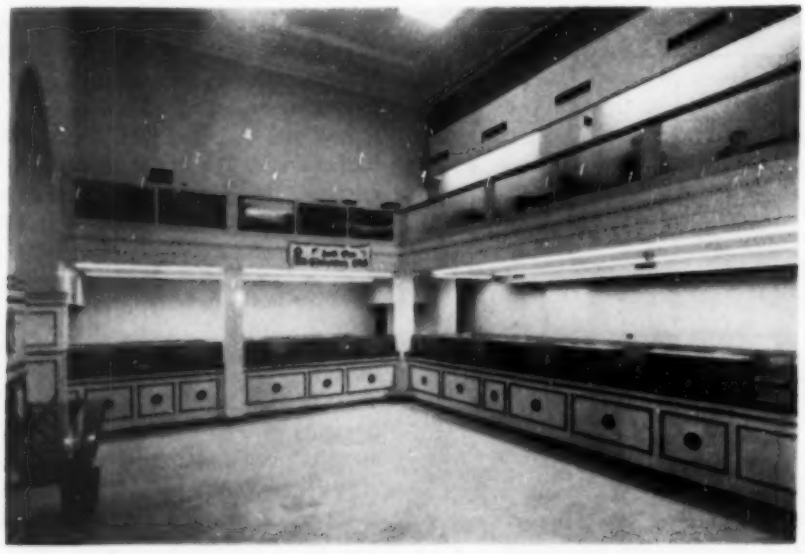
Exacting criteria of the architect and the physical limitations of the area made the job of re-lighting the Security National Bank, St. Louis, an interesting one for Edwin H. Lauth, President, City Sales, Inc., of St. Louis.

The architect wanted luminaires of a size and appearance in keeping with the proportions and dignity of the building, and for most of the work areas under the balcony recessed troffers were suitable. However, the ceiling construction in the high-ceilinged central area made recessed units impractical there. At the time the installation was planned, no standard luminaire measuring 4 x 4 feet or more with a smooth one-piece plastic covering was available. Such a unit was designed, 4 x 4 feet by 7 inches deep with a one-piece plastic formed element held in a double angle aluminum frame. The frame was made with hinged pins and spring latches to permit servicing by one man. After installation, when the body of the luminaire had been painted to match the ceiling, and an aluminum finished trim provided just above the plastic, the appearance is that of recessed equipment.

Another problem was to conceal the air conditioning duct. This was solved by running an "apparent" curtain wall in front of the duct, with strip lighting installed behind it. This provides added illumination on the desks along the wall, and the contrast of the surfaces enhances the duct into an architectural element.

With the new installation an average of 24 footcandles is provided in the central customers' area and in the tellers' working areas illumination is 37 to 49 footcandles.

Architect was Arthur Koelle, of Rathman, Koelle & Carroll; electrical contractor, the C. P. Bobe Co.



INSTALLATION AT KRAFT FOODS COMPANY
500 PESHTIGO COURT, CHICAGO, ILLINOIS.

Lighting a Taste-Testing Room

LIGHTING OBJECTIVE: To provide incandescent or fluorescent lighting, single or in combination, for judging the appearance of foods and food arrangements for color photography.

GENERAL INFORMATION: This room measures 15 x 20 x 9¾ feet. It is decorated as follows:

ceiling	white	73% RF
walls	white	75% RF
cabinets	white	87% RF
draperies	light gray	78% RF
venetian blinds	aluminum	70% RF
furniture	yellow	72% RF
floor	gray	38% RF

Here foods, packaged or in sample table servings, are judged for their flavor and appearance under incandescent, fluorescent, or daylight illumination, either separately or in combination. The room is also used for color photography of the food products.

INSTALLATION: Fourteen recessed Curtis (No. 2455 Special) lighting units containing 200-watt inside-frosted filament lamps, mirrored reflectors and Corning Fota-lite glass covers provided an average illumination of 66 footcandles after 100 burning hours. Curtis (No. 1752-C Special)

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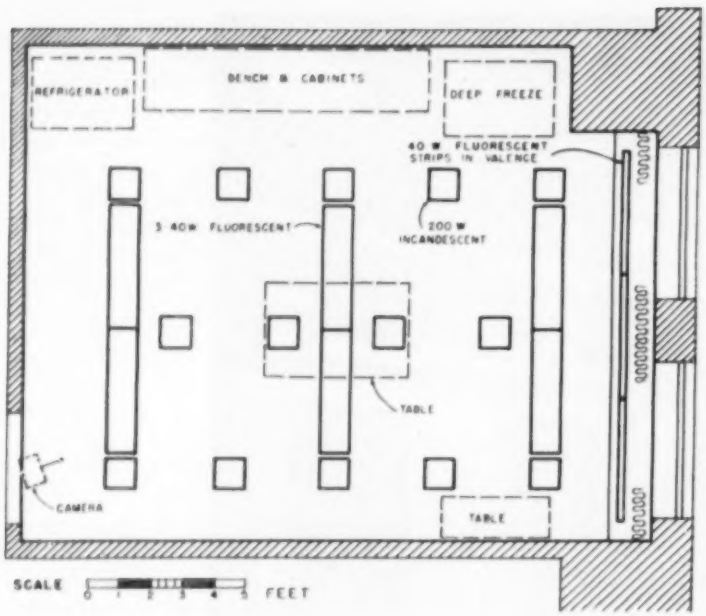


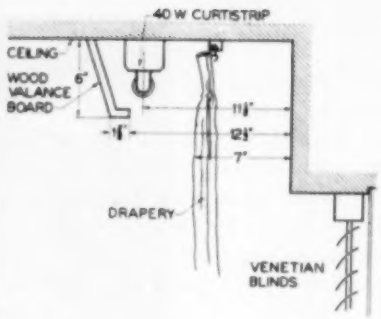


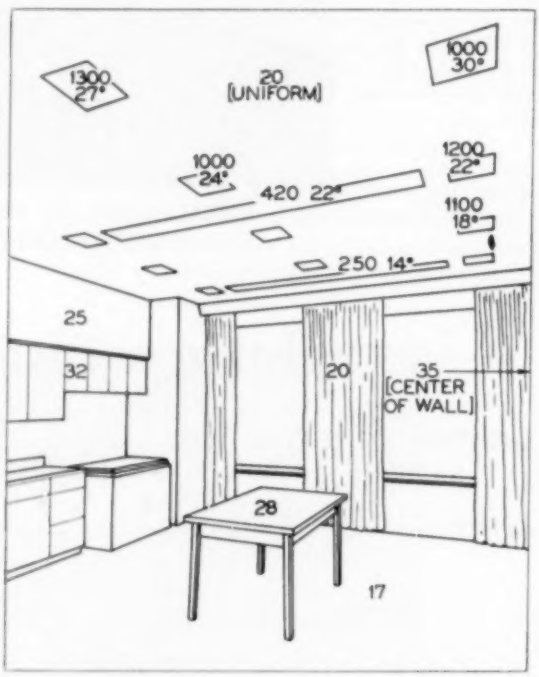
Figure 2. (left) Plan view.

Figure 3. (above) Detail of drapery lighting.

Figure 4. (below) Brightnesses (in footlamberts) measured from camera position. Angles are from horizontal.

Lighting a Taste Testing Room (Continued)

troffers with three 40-watt 4500K white fluorescent lamps and Fota-lite covers are wired to allow use of either the center lamp in each luminaire, the two outside lamps, or all three. After 100 burning hours these fluorescent units provided 15, 29 and 40 footcandles. The draperies are lighted by a Curtis No. 956-C single lamp 40-watt fluorescent unit behind a wood valance as shown in Fig. 3. Brightnesses with all units operating are shown in Fig. 4.



Lighting data submitted by Leslie B. Carlson, Kraft Foods Company, Chicago, Illinois as an illustration of good lighting practice and to aid in the design of similar installations.

Published by the Committee on Publications of the Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

I. E. S. Council—1954-1955

The Council of the Illuminating Engineering Society is comprised of the five Officers — President, Senior and Junior Vice-Presidents, Treasurer and General Secretary — two Past Presidents, six Directors, and the Regional Vice-Presidents, one from each of the ten Regions. Council meets every other month, October through June. The Council Executive Committee, which is made up of the five Officers, meets in the intervening months.

The President, Treasurer and General Secretary are elected for one-year terms, the Vice-Presidents for two years. The Past-Presidents on Council are those from the two preceding years. Directors are elected for three-year terms, two being elected each year.

Regional Vice-Presidents, whose photographs appear on following pages, each with his Region, serve two-year terms, five being elected each year.

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President

R. F. Hartenstein
Vice-President

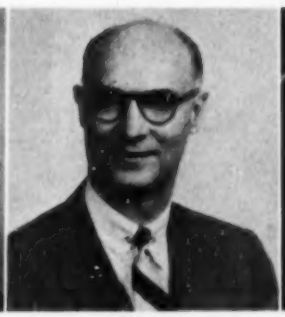
M. N. Waterman
Vice-President

Kirk M. Reid
General Secretary

G. J. Taylor
Treasurer

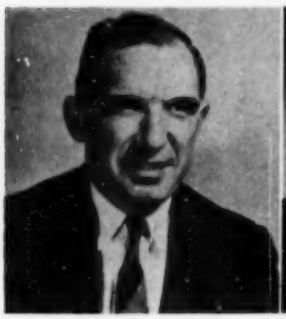
A. H. Manwaring
Past President

E. M. Strong
Past President



C. C. Shotwell
Director

W. A. Stannard
Director



L. C. Twichell
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J. S. Walsh
Director

F. C. Winkler
Director

J. F. Whitehead, Jr.
Director

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M. B. Hastings,
Regional Vice-President
and member of Council,
1953-1955

Norman Bethune
Hamilton Ontario
Chapter

Ewart M. Haacke
Montreal Section

L. C. Dupuis
Ottawa Chapter

J. D. Theriault
Quebec Chapter

M. K. Strang
Toronto Section

James Senez
Winnipeg Chapter

E. L. MacElmon, Chairman, Maritime Chapter,
was not available in time to obtain a photograph.

NORTHEASTERN REGION

C. W. McCormick, Regional Vice-President
and member of Council, 1954-1956

R. O. Mills
Connecticut Section

Harold H. Friedman
Eastern New York
Chapter

E. J. Perkins
New England Section

L. R. Anderson
New York Section

EAST CENTRAL REGION

Dorothy Nickerson
Capital Section

Clarence J. Berry,
Regional Vice-President
and member of Council,
1953-1955

Paul A. Kinsey
Eastern Pennsylvania
Section

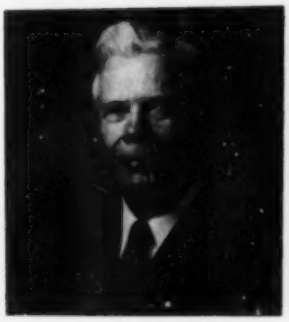
George F. Walter
Maryland Section

Westerman McCouch
Philadelphia Section

Carl J. Long
Pittsburgh Section

Jack Downing
Virginia Chapter

SOUTHERN REGION



Glenn Park,
Regional Vice-President
and member of Council,
1953-1955

George L. Morris
Alabama Chapter

John S. Williams
Arkansas Chapter

Gordon Wells
Carolinas Section

Paul P. Harrison
Georgia Section

James P. Fletcher
Mid-South Chapter

Arthur A. Levy
New Orleans Section

Roy E. Hallman
Palmetto Chapter

William H. Ridley
Tennessee Valley
Section

Names of Chairmen J. B. Foley, Florida Chapter; Furna E. Lott, Southeast Florida Chapter; and Hubert J. Pray, Mississippi Chapter, were not available in time to obtain photographs.

GREAT LAKES REGION

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Robert H. Goodman
Central New York Section

F. L. Detwiler
Cleveland Section

E. J. Rommel
Miami Valley Chapter

Floyd W. Sell
Michigan Section

T. W. Smith
Northwestern Ohio Chapter

Beattie M. DeLong
Ohio Valley Section

Royal M. Conheady
Rochester Section

W. F. Harper
Western Michigan Section

Bernard H. Plante
Western New York Section

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and member of Council, 1954-1956

J. W. Regan
Central Illinois Chapter

A. P. Larson
Chicago Section

R. W. Gibb
Cornhusker Chapter

Francis P. O'Connor
Heart of America
Section

Richard Holcombe
Iowa Section

Thomas B. Dustin
Milwaukee Section

Brooks Chassaing
St. Louis Section

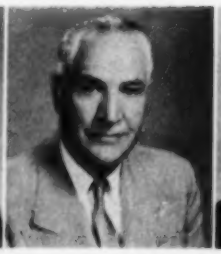
Don R. Schwarz
Twin City Section

Names of Chairmen Ralph E. Crockett, Indiana Chapter, and Orvin D. Hanke, Twin Ports Chapter, were not available in time to procure photographs.

G. B. Buck, II,
Regional Vice-President
and member of Council,
1953-1955

INTER-MOUNTAIN REGION

Charles O. Woodworth
Rocky Mountain
Section



Clarence F. Hoer
Southern Colorado
Chapter

Marvin Dansie
Utah Chapter

Names of Chairmen Ray Jonas, Arizona Chapter, and Bert G. Roughton, New Mexico Chapter, were not available in time to obtain photographs.

SOUTHWESTERN REGION

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and member of Council, 1953-1955

Floyd Covington, Jr.
Alamo Chapter

J. G. Harris
Ark-La-Tex Chapter

William E. Short
Oklahoma Chapter

H. D. Weisser
San Jacinto Section

John G. Felton, Jr.
Southwestern Section

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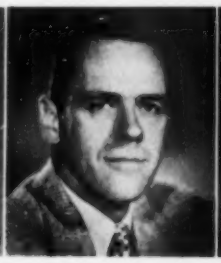
T. H. Doherty
British Columbia Section

John Ruffatto
Inland Empire Chapter

Marvin S. Prestwood, Jr.
Oregon Section



Charles C. Fields
Puget Sound Section

Gordon J. Roper
Vancouver Island Chapter

SOUTH PACIFIC COAST REGION

Dan M. Finch, Regional Vice-President
and member of Council, 1954-1956

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Mother Lode Chapter

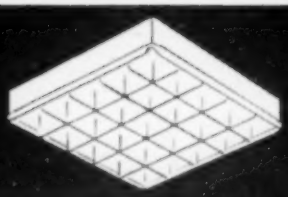
James E. Barnes
Northern California Section

J. Walter Howard
San Diego Chapter

Gene Smith
San Jose Chapter

F. Edwin Blair
Southern California Section

Only - Luve·tile



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LUVE-TILE in the long run is the most economical illuminated ceiling you can buy.

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LUVE-TILE comes in 4 shades making possible unlimited colour combinations. Sprinklers and air ducts are concealed and wiring and other work may be simply surface mounted. Also low cost acoustic material may be sprayed on the cavity above the tile for sound proofing.

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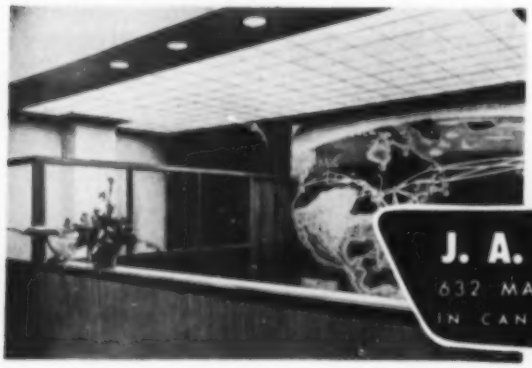

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TELECAST

LIGHTING NEWS OF CURRENT INTEREST

Deadline January 1 for I.E.S. Gold Medal Nominations

January the first is the closing date for receipt of nominations for the I.E.S. Gold Medal Award. Nominations for this, the highest award of the Society, are invited from all members for consideration by the Medal Award Committee.

The Gold Medal is awarded to give recognition to meritorious achievement which has conspicuously furthered the profession, art or knowledge of illuminating engineering. The following points should be observed in making nominations.

(1) Candidates need not be members of the Society, or citizens of the United States or Canada. Nominations may be made at any time by any member of the Society, by presenting to the Medal Award Committee the name of the individual whose accomplishments in his field are deemed worthy of such recognition — in the field of engineering, design, applied illumination, optics, ophthalmology, lighting research, education or administration and management.

(2) In order for a candidate to be considered for the award of a given year, a letter outlining the qualifications and requesting consideration of the candidate shall be delivered to the Medal Award Committee (care of the I.E.S. General Office) before January 1 of that year.

(3) Nominations and records on file from previous years, as reviewed and referred to the next year's committee by the previous Medal Award Committee, will be given consideration along with new nominations.

The I.E.S. Gold Medal was established in 1944 and is accompanied by a certificate of award. In past years it has been presented to: George H. Stickney, Preston S. Millar, E. C. Crittenden, Matthew Luckiesh, Sir Clifford Paterson, Ward Harrison, William F. Little, and H. H. Magdsick. Most recent recipient, this year's Medallist, is Erwin F. Lowry.

Increased Farm Use of Electrical Equipment Urged

According to some estimates a group of 1000 farms with electric service represents a community of possibly 4000 population — homes and productive industry. An area of 4000 farms is a community of possibly 15 to 16 thousand population — a moderate sized city.

Around such information as this the Inter-Industry Farm Electric Utilization Council is building an ambitious program designed to increase the use of electrical equipment on the farm, and by so doing increase the use of electricity.

The program is being launched at a series of five area meetings around the country this fall, at which the plans and methods for statewide power use activities are being presented to all interested industry groups.

The Council is the outgrowth of a temporary Power Use Steering Committee formed during an electric sales conference held in Chicago last March, sponsored by the Rural Electrification Administration. Presently, the Council is composed of six members representing rural electric cooperatives, electric utility companies and electrical equipment and appliance manufacturers. Fred H. Strong, Deputy Administrator of REA, is the Council's chairman.

Back Copies of Transactions Available

Anyone needing copies of the following random issues of *I.E.S. Transactions* and ILLUMINATING ENGINEERING, is welcome to receive them on request to Mr. H. A. Breeding, General Electric Company, Measurements and Industrial Products Division, 920 Western Ave., West Lynn 3, Mass. The issues available are:

March 1925
October 1928
January through September 1929
February, March and April 1930
March 1940
June 1946
November, December 1947
January 1948
March through July 1948
November 1948
March, June and October 1949
January 1950
April through July 1950
September 1950
November and December 1950

All of 1951 except September and November

All of 1952 except February, March, June, August and November

January and March of 1953.

A.H.L.I. Opens Experimental Model Home

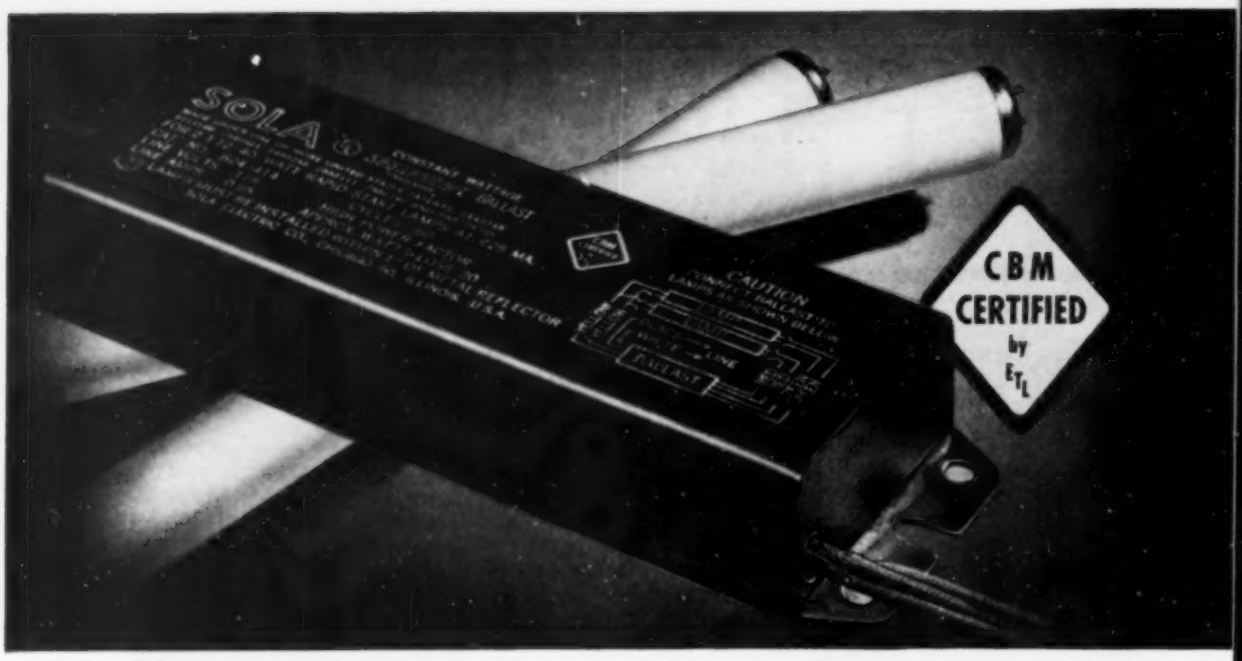
To demonstrate the advantages of built-in lighting fixtures in the home, the American Home Lighting Institute has opened an experimental model home in the north suburban area of Chicago, open for inspection by the public.

The home, a five-room, ranch type frame structure, is completely furnished and features regular production models of modern lighting luminaires throughout. During public display hours, members of A.H.L.I. are on hand to gain

(*Continued on page* 17A)

Report on the National Technical Conference To Be in November I.E.

The complete report on the National Technical Conference, with photographs of the major events, awards, and other highlights of the Atlantic City meeting, will be featured in the Telecast Section of the November issue of I.E.



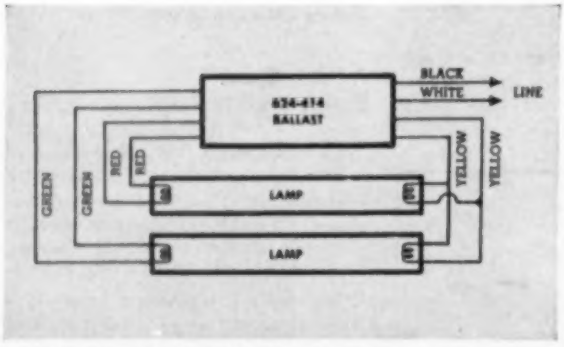
LOW, COMPACT RAPID-START BALLAST CASE: Case height 1-13/16", width 3-1/8", length 8-5/16". Fits all standard rapid-start channels. Weighs only 5-3/4 pounds. Leads are clearly color-coded, and long enough for easy hook-up without splicing.

Sola Constant Wattage Ballasts for rapid-start lamps automatically, unfailingly maintain the performance you specify

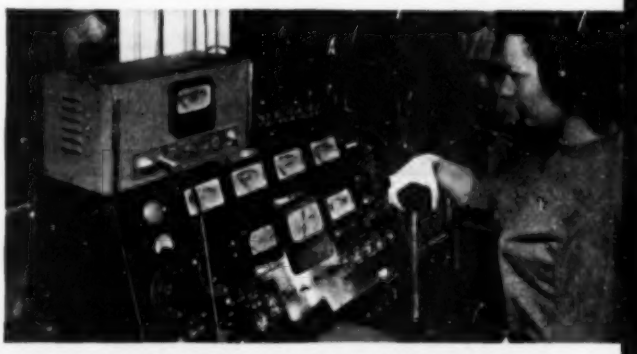
The rapid-start fluorescent lamp and the Sola Constant Wattage Ballast form the heart of a nearly perfect lighting system. When incorporated by the fixture manufacturer into a finished luminaire, you enjoy the advantages of instant-start with the economy of pre-heat fluorescent lighting.

The following five distinct points of superiority of the Sola constant wattage circuit make Sola ballasts particularly well suited for operation of rapid-start lamps.

1. LONGER LAMP LIFE: Lamp life is inversely proportional to the peak/rms ratio of the lamp's current



SIMPLIFIED FIXTURE INSTALLATION: Only two wires, directly from ballast, to connect on line — no wiring from line to lamp holders. The double wound circuit of the Sola Constant Wattage Ballast is self protecting against shock hazard for absolute safety.



EVERY BALLAST TESTED FOR LOW NOISE LEVEL: Sola ballasts are individually checked with a crystal sound probe to insure low hum level before release. Being a magnetic device, every transformer has some hum; however, good design and construction results in quiet Sola ballasts.

wave shape. Sola ballasts' peak/rms ratio is approximately 1.5 @ 118v — extremely low with good wave shape.

2. RELIABLE STARTING: The higher the voltage from lamp electrode to grounded fixture (an important starting aid) the more positive the starting. Sola ballasts provide 300v across lamp-to-ground with perfect safety — approximately 60% more than conventional autotransformer types.

3. CONSTANT LIGHT OUTPUT: Lumen output held constant to within ±2% over a primary range of 106-130v—you get all the light you paid for regardless of line voltage fluctuations as great as 20%.

4. QUIET OPERATION: Progressive compound pouring, special lamination design and pressed-in core-and-coil construction minimize lamination hum —ballasts are suitable for quiet area installations.

5. LONG BALLAST LIFE: Temperature rise is low under normal operation. When one or both lamps fail or rectify, ballast operating temperature is reduced, not increased—result is low ballast maintenance cost.

If you manufacture fixtures, or if you specify, operate or maintain lighting installations, investigate the advantages of a Sola Constant Wattage Ballasted rapid-start system. Write for full information, or request a Sola sales engineer to call with all the facts.

CBM CERTIFIED by ETL

SOLA ELECTRIC CO.
4633 W. 16th St., Chicago 50
Phone Bishop 2-1414.
Representatives in principal cities.

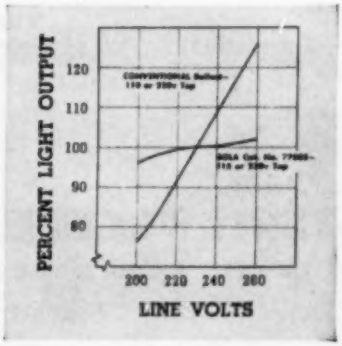
WRITE FOR BULLETIN 3J-FL-199

SOLA *Constant Wattage* BALLASTS

67,560 STARTS ON SOLA BALLASTED LAMPS: Sola Constant Wattage Ballast and other leading ballasts compared on accelerated-start life test of rapid-start lamps. Sola ballasted lamps averaged 19% more starts before lamps failed.

60% MORE STARTING VOLTAGE: Patented Sola ballasts provide 300v from lamp to starting aid for positive starting (conventional autotransformer types only 180v). U.L. listed. Completely safe due to Sola's isolated secondary circuit design. Lamps start even under adverse conditions of temperature, humidity and lamp life.

LAMP CURRENT WAVE SHAPE: Sola "CW" tested 16.7% lower peak/rms ratio @ 118v than ordinary ballast.



±2% LUMEN REGULATION: Stable light output of Sola "CW" ballast compared with three typical non-regulating units, each operating two T-12, 40w rapid-start lamps.

PRODUCTION LINE TESTING FOR REGULATING ACTION: Sola Constant Wattage Rapid-Start Ballast tested by varying primary voltage from 106-130v. Light output must hold constant within ±2%. This is one of many tests made to insure specified performance.

NOW 90% EFFICIENCY

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(*Continued from page* 13A)

first-hand consumer reaction to the installed lighting units.

According to Miss Minita Westcott, managing director of the Institute, the purpose of the home is twofold: first, to provide institute members with a more personal contact with the ultimate consumer, obtaining a more direct feel of the sales potential for installed home lighting fixtures, and also to gather data on buying urges and appeals for styles in equipment.

Architect for the home is Jules Marling of Chicago. The Institute's two-color emblem is prominently displayed for identification.

Research Grant Made For Ultraviolet Studies

The National Research Corporation Scientific Trust has made a grant to the University of California at Riverside for the support of basic research in photochemical studies in the far ultraviolet and Schumann Regions. The grant, of $3,980, is for a continuation of the work by Dr. James N. Pitts, who was formerly doing this research at Northwestern University under a grant from the trust.

The National Research Corporation Scientific Trust was established in 1951 to provide financial support in fields of basic research.

Retailers Commended for Good Lighting Techniques

The efforts of retailers in achieving an inviting store appearance and pleasant shopping atmosphere with attractive store fronts, correct lighting and exciting use of color received commendation from John W. H. Evans, managing director of the National Retail Industry Show at a recent meeting of the Show's Planning Board. This approval, however, was given in a plea for store owners to coordinate these improvements with efficient accounting, maintenance, merchandise handling and warehousing methods, without which, states Mr. Evans, even the most modernized stores can fail.

So that retailers can learn first hand how to coordinate all their improvement plans in both selling and non-selling areas, the National Retail Industry Show, to be held January 7-11 at Madison Square Garden, New York City, will place equal emphasis on all areas of stores, their offices and warehouses.

LIGHTING CALENDAR

Society Events

March 31 - April 1, 1955 — Southern Regional Conference, Ft. Harrison Hotel, Clearwater, Fla.

April 3-5, 1955 — Southwestern Regional Conference, Gunter Hotel, San Antonio, Texas.

April 11-13, 1955 — Inter Mountain Regional Conference, Phoenix, Arizona.

April 14-15, 1955 — South Pacific Coast Regional Conference, Statler Hotel, Los Angeles, Calif.

April 25-26, 1955 — Pacific Northwest Regional Conference, Harrison Hot Springs Hotel, Harrison Lake, B. C.

May 2-3, 1955 — Midwestern Regional Conference, Edgewater Beach Hotel, Chicago, Ill.

May 12-13, 1955 — Canadian Regional Conference, Hotel Mount Royal, Montreal, Que.

May 19-20, 1955 — East Central Regional Conference, Abraham Lincoln Hotel, Reading, Pa.

June 10-11, 1955 — Northeastern Regional Conference, Ft. William Henry Hotel, Lake George, N. Y.

September 12-16, 1955 — Illuminating Engineering Society, National Technical Conference, Hotel Statler, Cleveland, Ohio.

Industry Events

October 11-13, 1954 — International Association of Electrical Inspectors, Western Section, Louisville, Ky.

October 11-15, 1954—American Institute of Electrical Engineers, Fall General Meeting, Chicago, Ill.

October 17-22, 1954—Society of Motion Picture and Television Engineers, Semi-annual Convention, Los Angeles Ambassador, Los Angeles, Calif.

October 18-22, 1954 — 42nd National Safety Congress & Exposition of the National Safety Council, Chicago, Ill.

October 24-27, 1954 — Board of Governors, National Association of Electrical Distributors, Hershey Hotel, Hershey, Pa.

October 25-27, 1954—International Association of Electrical Inspectors, Southern Section, Tampa Terrace Hotel, Tampa, Fla.

October 27-30, 1954 — National Electrical Contractors, Annual Convention, Jung Hotel, New Orleans, La.

November 8-11, 1954 — National Electrical Manufacturers Association, Haddon Hall Hotel, Atlantic City, N. J.

November 15-17, 1954 — American Standards Association, 5th National Conference on Standards and 36th Annual Meeting, Hotel Roosevelt, New York, N. Y.

November 18-19, 1954 — National Farm Electrification Conference, Schenectady, N. Y.

November 28 - December 3, 1954 — The American Society of Mechanical Engineers, Annual Meeting, Statler Hotel, New York, N.Y.

January 7-11, 1955 — National Retail Industry Show, Madison Square Garden, New York, N. Y.

January 31 - February 4, 1955 — American Institute of Electrical Engineers, Winter General Meeting, Hotel Statler, New York, N. Y.

March 13-18, 1955 — National Electrical Manufacturers Association, Edgewater Beach Hotel, Chicago, Ill.

June 27 - July 1, 1955 — American Institute of Electrical Engineers, Summer General Meeting, New Ocean House, Swampscott, Mass.

October 3-7, 1955 — American Institute of Electrical Engineers (Fall General Meeting), Morrison Hotel, Chicago, Ill.

October 5-7, 1955 — Canadian Electrical Manufacturers Association (11th Annual Meeting), Sheraton-Brock Hotel, Niagara Falls, Ontario, Canada.

October 24-26, 1955—37th Annual Meeting and Sixth National Conference on Standards, American Standards Association, Washington, D. C.

Engineering Graduate Studies Supported by Cincinnati Industries

For the second consecutive year the local industry committee in Cincinnati cooperating with the Engineers' Council for Professional Development is giving direct support to the graduate engineering program for part-time students established recently at the University of Cincinnati. This action is part of the activity relating to the "community project" in the professional development of young graduate engineers, now being studied by the ECPD committee in Cincinnati.

Advanced courses in mathematics and fundamental sciences are being made available along with elected groups of engineering courses. Courses may be taken separately for the training which each offers, or a number of courses may be integrated into degree programs of interest to the individual student and leading to the degree of Master of Science.

The courses announced for this Fall are the second part of a series of yearly offerings in planned sequences designed to meet the needs of college graduates in the fields of physics and chemistry and in aeronautical, civil, chemical, electrical, mechanical and metallurgical engineering.

(*Continued on page* 18A)

LOOKING FORWARD TO '55. Plans are here being discussed for the 1955 National Technical Conference to be held in Cleveland next year. At this second meeting of committee chairmen last August, which was held at the Wakefield Nautical Museum, Vermilion, Ohio, are, left to right: seated, T. D. Wakefield, Printed Publicity; Mrs. W. H. Kahler, Ladies Reception; Charles L. Amick, Conference Chairman; Mrs. F. E. Mueller, Ladies Reception; and R. W. Butts, Entertainment; standing, R. M. Smart, Registration and Reception; F. L. Detwiler Hotel Reservations; Theodore Ake, Jr., Attendance; J. J. Neidhart, Local Publicity; R. N. Green, Finance; and H. A. Lawrence, Attendance.

In order to insure regular offerings with suitable class sizes in essential courses of the degree programs, the University has established a pattern of offering and a cycle of rotation of courses. Hence some of the subjects offered this year may not be available for another two or three years, but will be rotated each year with related courses in the same fields of interest.

Nearly 400 young engineers have enrolled in the Fall semester sessions. Last year, the first year of the expanded offerings, 285 students were enrolled in the nine courses which had been suggested by the industry group working with the college administrators in planning the program.

"Continued Education" is one of the six points recommended for emphasis in the ECPD program outlined in the Professional Training Committee report dealing with "The First Five Years of Professional Development." The other points include orientation and training in industry, professional identification, integration into the community, self-appraisal, and selected reading.

The "community project" in professional development emphasizes the tripartite cooperation of industry, the engineering societies and the universities.

National Science Foundation Offers Graduate Science Fellowships

About 800 students with special abilities in science will be selected for a year of graduate scientific study during the academic year 1955-1956 in the National Science Foundation's Fourth Annual Graduate Fellowship Program. Closing dates for receipt of applications are December 20, 1954 for post-doctoral applicants and January 3, 1955 for graduate students working toward advanced degrees in science. The selections will be announced on March 15, 1955.

National Science Foundation fellowships are awarded to United States citizens who will begin or continue their studies at the graduate level in the life and physical sciences during the 1955-1956 academic year. Selections will be made solely on the basis of ability. The majority of the fellowships will go to graduate students seeking master's or doctor's degrees in science, although about 100 awards will be made to post-doctoral applicants. Science students who are now college seniors are encouraged to apply for the awards.

The rating system for selection of pre-doctoral Fellows will be based on: (1) scores on tests of scientific aptitude and achievement; (2) academic records; (3) written evaluations of each individual from his faculty advisors and other qualified observers. Postdoctoral applicants will not be required to take the examinations. Applicants will be rated by special Fellowship Panels, established by the National Academy of Sciences. Final selection will be made by the National Science Foundation.

Stipends for the graduate fellowships will vary with the academic status of the Fellows. First Year Fellows — students entering graduate school for the first time or those who have had less than one year of graduate study will receive annual stipends of $1,400. Fellows who need one final academic year of training for the doctor's degree will receive annual stipends of $1,800. Fellows between these groups will receive stipends at the rate of $1,600 annually. The stipends for postdoctoral Fellows will be $3,400 per year. Dependency allowances will be made to all married Fellows. Tuition and laboratory fees and limited travel allowances will also be provided.

National Science Foundation Fellows may attend any accredited nonprofit institution of higher education in the United States or similar institutions abroad.

Last year 736 selections were made out of 3,300 applicants. Also, about 1,400 individuals were named on an Honorable Mention list, which was made available to deans of graduate schools.

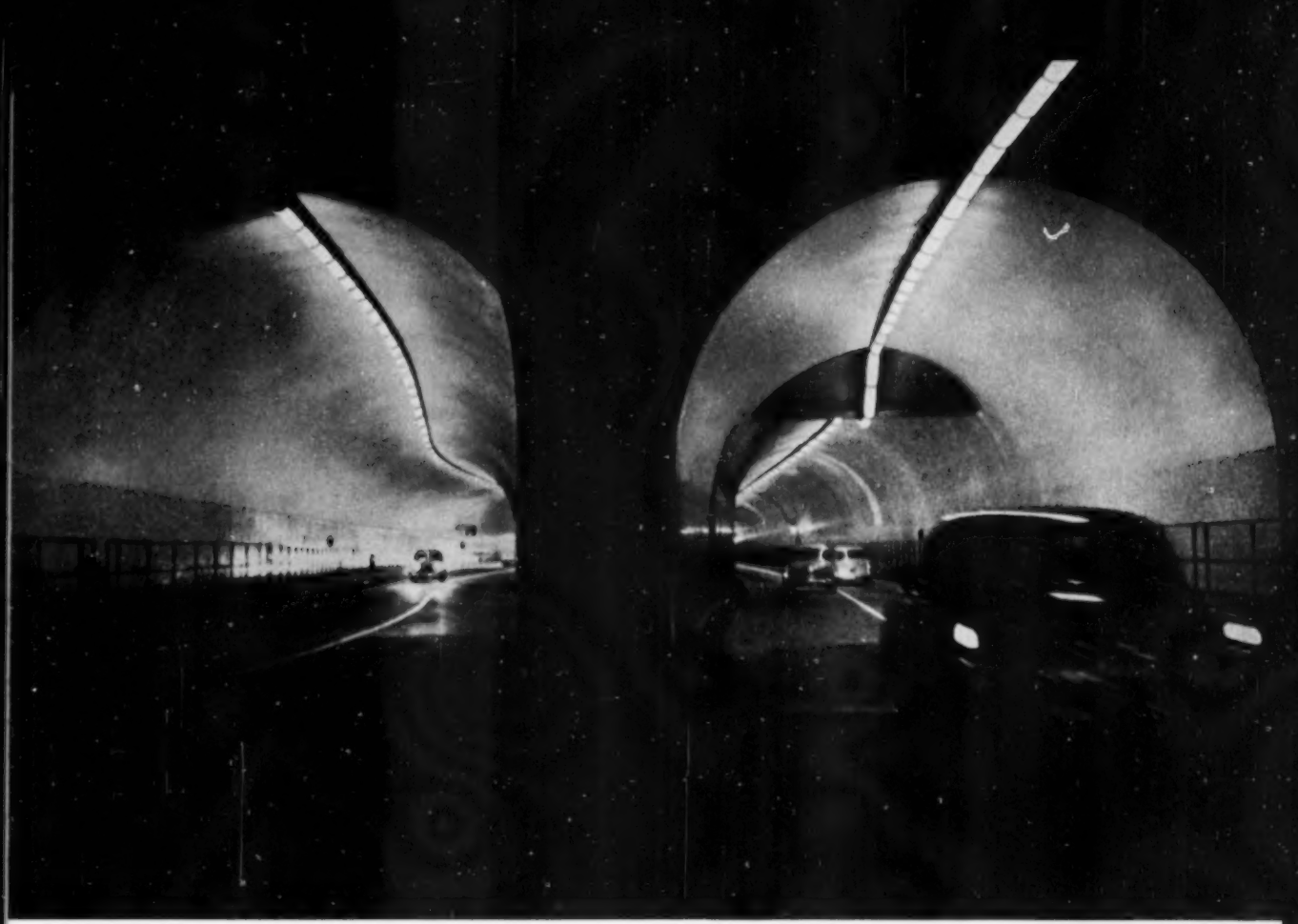
Applications for the 1955-1956 National Science Foundation Fellowship Program may be obtained from the Fellowship Office, National Research Council, Washington 25, D. C.

Russia Increases Number Of Engineering Graduates

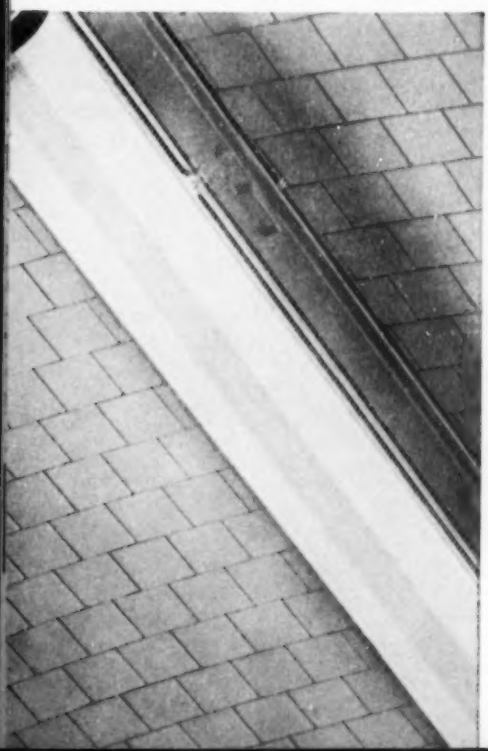
A warning that the United States may be falling behind Russia in the race to produce trained engineers was sounded in a paper read before the fall meeting of the American Society of Mechanical Engineers in Milwaukee, September 10. Author of the paper was M. H. Trytten, director of the office of Scientific Personnel of the National Research Council, and a member of the Committee on Specialized Personnel which advises the Director of Defense Mobilization on matters relating to the mobilization of scientists, engineers and other specialists. The paper is an outgrowth of nearly two year of research in conjunction with the Russian Research Institute at Harvard University.

Dr. Trytten pointed out that the total number of trained engineers in Russia

(*Continued on page* 23A)



3232 feet of extruded Du Pont "Lucite" acrylic resin is used in the modern Broadway Tunnel that extends under San Francisco's Russian Hill. Below: Close-up of a fixture of "Lucite." This engineering material provides high visibility without glare. Has durability and beauty. (Manufactured by Sunbeam Lighting Co., Los Angeles, California.)



PRIZE-WINNING LIGHTING

These weather-resistant, glare-proof fixtures feature extruded Du Pont LUCITE®

San Francisco's Broadway Tunnel has set a new high standard for *scientific lighting.* It was planned that way. Lighting engineers specified fixtures of Du Pont "Lucite" acrylic resin to achieve maximum visibility without glare . . . safe and gradual changes in light intensity.

These fixtures of extruded "Lucite" are ribbed on the inside to diffuse light. Their smooth outer surfaces resist weathering and exhaust fumes. They are cleaned easily with a 100 p.s.i. water-detergent spray.

Beautiful "Lucite" is economically fabricated and will conform to any design. It comes in a variety of clear, translucent and opaque colors. Write to the Polychemicals Department, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware for further information on this durable engineering material.

DU PONT

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

For the industrial lighting value of your lifetime

See! Examine! Compare!

THE NEW LIFETIME CFI SERIES

Day-Brite announces the sensational new CFI-25 with 25% upward component and the CFI-10 with 10% upward component—both with important new features that promise a lifetime of unparalleled lighting performance.

From Day-Brite, the pioneer, came many of the early developments in uplighted industrial fixtures.

Now — from Day-Brite, the leader, comes a great new advancement in industrial lighting — the new *Lifetime CFI series.*

Today, the CFI-25 brings you all the desirable comfort benefits of 25% uplighting *within a practical price range.*

This is a goal sought by many in the lighting industry. A few manufacturers have actually marketed 25% uplighted fixtures. Until now, none had succeeded in keeping fixture costs within reasonable limits.

Day-Brite—and only Day-Brite—offers you advanced visual comfort for industry at an economically justified price. If you can afford *any* industrial lighting, you can now afford the lifetime benefits of the finest fixtures ever to reach the market.

See! Examine! Compare!

FULL 8-FOOT PORCELAIN REFLECTORS! An exclusive *Lifetime CFI* feature! Competitive fixtures give you two 4-foot reflectors to form an 8-foot section — twice as many pieces to handle during installation, twice as many joints to interfere with alignment of runs. Another exclusive: every square inch of reflection surface is finished in snow-white Lifetime porcelain enamel. Apertures die-embossed for strength and appearance.

CFI-25 REFLECTOR SUPPORTS 358 POUNDS! Here's a rugged test for any reflector. Supported only at its extreme ends, the 8-foot CFI-25 reflector remains perfectly straight and rigid bearing the full weight of a 358-lb. man—no bend, no sag, no spread. That's because new ribbed construction reinforces lateral stability and a longitudinal "V" louver reinforces lengthwise rigidity (and also provides comfortable 30° cross-wise shielding). These super-rigid reflectors assure straight, true alignment of fixture runs.

See! Examine! Compare!

Complete details of the CFI-25 (left) are covered in Bulletin OD-626. The CFI-10 (right) is described in Bulletin OD-625. Write for either or both today! Day-Brite Lighting, Inc., 5432 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

See! Examine! Compare!

You must see this revolutionary new industrial series yourself to appreciate the lifetime advantages it offers. Examine the CFI-25 and the CFI-10. Compare them with other industrial fixtures. Mark your calendar now to arrange a *Lifetime CFI* demonstration—and know firsthand why this new series is the industrial lighting value of your lifetime!

"DECIDEDLY BETTER"
DAY-BRITE
Lighting Fixtures

496

CALL OR WRITE YOUR NEAREST DAY-BRITE REPRESENTATIVE

Whether the signal says:

"WAFFLE IS BAKING"...

or

"DANGER AHEAD"...

KOPP *Engineered* GLASS

delivers the message!

In visual signal systems, a lens or a color filter is called upon to actually *deliver* the message. It may show that a home appliance is in operation, or warn motorists or trainmen of danger ahead. Whatever its duty, if it is designed and made of glass by Kopp, you can be certain of its heat-resistance high quality.

Kopp engineers have the skill, experience and equipment to design and manufacture all types of signal lenses, color filters and special glass parts. Parts produced by Kopp craftsmen are accurately made and dependably uniform.

We will be glad to study your requirements and to develop designs that will meet your most exacting requirements.

Write for
the new brochure describing the design and manufacture of Kopp Glass Products.

KOPP GLASS

KOPP GLASS, Inc.

SWISSVALE, PA.

Building—*Through Business*—for a better America!

support Junior Achievement

(*Continued from page* 18A)

today is closely comparable to the number in the United States. To accomplish this, the Russians have increased the number of engineering graduates from 29,000 in 1948 to more than 50,000 in 1954. In contrast, the United States graduated only 19,000 engineers in 1954, according to the paper.

To meet the challenge, Dr. Trytten advised improving the teaching of science at the high school level; expanding the training of scientists and engineers, and the adoption of a consistent policy for the preservation of professional manpower, especially engineering and scientific personnel.

School Planning Institute To Be Built at U. of Indiana

Plans are well underway for a school planning institute and laboratory to be built on the campus of the University of Indiana, at Bloomington. A nonprofit foundation, incorporated under the name of Indiana School Planning Laboratory Fund, Inc., has been chartered to raise funds from industry and other sources to build the laboratory. Officers of the foundation currently serving are: F. I. Wilson of F. W. Wakefield Brass Co., Vermilion, Ohio, president, and D. B. Harmon, Consulting Educationist, Austin, Texas. Paul W. Seagers, consultant for school building planning at the university is director of the foundation on the campus.

Three laboratories will provide facilities for study of three main factors in a school's environment: (1) temperature, humidity and air movement; (2) sound patterns and (3) lighting. In the latter, studies will be made of the responses of pupils to intensities, brightnesses and directions of light under a wide range of combinations.

One classroom will be equipped with light directing glass block in a unilateral clerestory and a glass block window wall with vision strip, so mounted that it can be removed and replaced with other designs of fenestration. A removable set of opaque ceiling panels can be inserted to make a continuous ceiling, the unilateral clerestory being cut off when low ceiling, deep room experiments are conducted. Opposite the window wall is an opening that can be closed with opaque wall panels or opened for use in bilateral clerestory experiments. This opening can be filled with clear glass, glass block or other types of bilateral lighting controls. Both the permanent ceiling and the removable ceiling contain electric sources permitting 50 watts per square foot so that various types of artificial lighting can be set up for experimental purposes.

A model classroom, for demonstration purposes, is so engineered that floors, walls and window sections can be changed at will. A remote controlled elevating system is included to permit comparison showing of two different types of windows in relation to one type of room design. An artificial sky, also remotely controlled, will be located behind a window section so that various orientations can be demonstrated as well as various altitudes and azimuths of the sun for different latitudes and different times of the year.

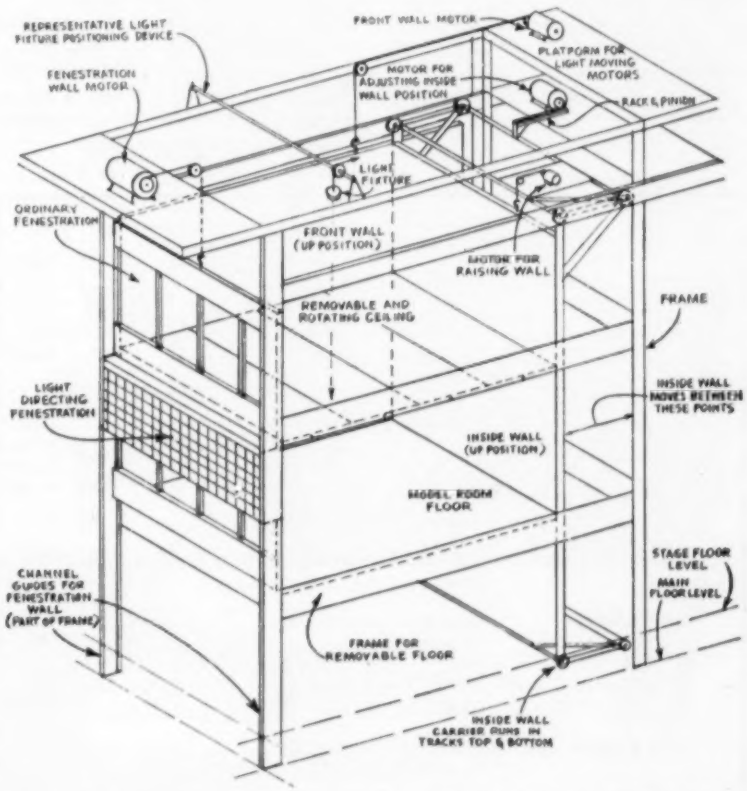
Ceiling height of the model classroom can be changed quickly from 9 to 12 feet and intermediate, and the width varied from 24 to 32 feet.

Above the ceiling will be scaled lighting fixtures of designs such as fluorescent luminous indirect and louvered, incandescent luminous-indirect, concentric ring and others. The various types can be dropped from concealed sources in the ceiling and suspended for demonstration of illumination levels, quality, and distribution patterns. Miniature furniture of various types will be available for curricular approaches to room design.

Chicago Lighting Institute Offers Annual Fall Programs

The Fall Quarter Courses, presented annually by the Chicago Lighting Institute in cooperation with the Chicago Section of I.E.S. and the Illinois Institute of Technology, started this year the first week in October. Classes and laboratory sessions are, as usual, being held at the Institute. Tuition for each set of courses is $25.

(*Continued on page* 24A)


REPRESENTATIVE LIGHT FIXTURE POSITIONING DEVICE
FENESTRATION WALL MOTOR
FRONT WALL MOTOR
PLATFORM FOR LIGHT MOVING MOTORS
MOTOR FOR ADJUSTING INSIDE WALL POSITION
RACK & PINION
LIGHT FIXTURE
ORDINARY FENESTRATION
FRONT WALL (UP POSITION)
MOTOR FOR RAISING WALL
FRAME
REMOVABLE AND ROTATING CEILING
LIGHT DIRECTING FENESTRATION
INSIDE WALL MOVES BETWEEN THESE POINTS
INSIDE WALL (UP POSITION)
MODEL ROOM FLOOR
STAGE FLOOR LEVEL
MAIN FLOOR LEVEL
CHANNEL GUIDES FOR FENESTRATION WALL (PART OF FRAME)
FRAME FOR REMOVABLE FLOOR
INSIDE WALL CARRIER RUNS IN TRACKS TOP & BOTTOM

MODEL classroom, at the Laboratory of the School Planning Institute to be located at the University of Indiana, has remotely controlled adjustable ceiling height from 9 to 12 feet and room width from 24 to 32 feet.

Correction!

In the report on the Northeastern Regional Conference, August I.E., a photo caption mistakenly identified Ed Cole as Conference Chairman. Chairman of the Conference was, of course, Francis Clark, as listed at the end of the report. Apologies to Mr. Clark.

PRE-CONFERENCE Conference. Twenty-three lighting specialists from 18 electric utilities throughout the country, on their way to the I.E.S. National Technical Conference in Atlantic City, stopped for a two-day conference on illumination at the Westinghouse Bloomfield Lamp Division, September 9-10. At a dinner meeting of the group, S. G. Hibben (at rear in photo), director of applied lighting for Westinghouse, and I.E.S. Past President, spoke on the utility aspects of lighting, and on Light's Diamond Jubilee.

The Lighting Fundamentals Course, with Raymond Wozniak as lecture instructor, consists of twelve 1½-hour classes, held once a week, accompanied by the six laboratory periods with James Burke as instructor every other week.

Wiring Design Course 2A is under Frank R. McShane, and has as prerequisites the Wiring Design Course I or the equivalent in training or experience. This advanced course consists of ten classes, scheduled weekly.

The third program is the Lighting Design Problems Course, with twelve weekly lectures and six bi-weekly laboratory sessions. R. R. Lusk is lecture instructor and Raymond Wozniak superintends the laboratory work.

I.E.S. Regional Conferences—1955

(Tentative Schedule)

Southern	Fort Harrison Hotel Clearwater, Florida	March 31-April 1
Southwestern	Gunter Hotel San Antonio, Texas	April 3-5
Inter-Mountain	Phoenix, Arizona	April 11-13
South Pacific Coast	Statler Hotel Los Angeles, California	April 14-15
Pacific Northwest	Harrison Hot Springs Hotel Harrison Lake, British Columbia	April 25-26
Midwestern	Edgewater Beach Hotel Chicago, Illinois	May 2-3
Canadian	Mount Royal Hotel Montreal, Quebec	May 12-13
East Central	Abraham Lincoln Hotel Reading, Pennsylvania	May 19-20
Northeastern	Fort William Henry Hotel Lake George, New York	June 10-11

I.E.C. Issues Eight Recommendations in Electrical Field

Eight international recommendations have been released by the International Electrotechnical Commission. These standards for the electrical field include:

Recommendations for Insulation Co-ordination
Specifications for Tungsten Filament Lamps for General Service
Specification for Alternating Current Circuit Breakers
International Electrotechnical Vocabulary — Machines and Transformers
International Electrotechnical Vocabulary — Fundamental Definitions
Current Ratings and Frequencies
Dimensions of Motors
Lamp Caps and Holders

ABOUT PEOPLE

Robert F. Hartenstein, I.E.S. Vice-President, who has been in charge of electric and steam heating sales in Ohio Edison Company's Akron Division for the past eleven years, has been named to the utility's general headquarters staff in Akron to supervise commercial and farm electric sales activities for the entire company. The appointment was effective October 1. In his new assignment, Mr. Hartenstein will advise and assist Ohio Edison's division managers throughout the 35-county service area in matters relating to the promotion and sale of electricity for commercial lighting, heating, cooking and refrigeration, and farm electrification. Mr. Hartenstein's Akron Division position will be assumed by **Charles B. Olds**, now in the utility's rate and evaluation department. Effective also October 1, was the appointment of **Robert W. Butts** as general supervisor of dealer coordination for the company, with direct supervision over the co-operative sales promotion activities carried on by the utility.

At a meeting of the Board of Directors of Benjamin Electric Manufacturing Co., Des Plaines, Ill., on September 7, **Walter D. Steele**, a co-founder of the company in 1901, tendered his resignation as president, a post he had held since 1928. The following officers were then elected: **Hoyt P. Steele**, President; **C. F. W. Alfvin**, Vice-President and Treasurer; **R. Allen Benjamin**, Secretary; **J. H. Fall III**, Vice-President and General Sales Manager; **George A. Hamm**, Controller and Assistant Secretary; **Mary Asping**, Assistant Secretary; **Fred G. Klingel**, Assistant Treasurer. The company's new President then announced the promotion of eight executives to new

(Continued on page 38A)

COMPARE...

Exclusive on the Ortho-77 is the Uni-Race channel for automatic alignment, the Plug-in Socket for safe handling without disconnecting the circuit and unheard of flexibility, and the rugged V channel with integrated construction for permanence of shape.

	Ortho-77	Conventional
OVERALL COST	Reports show savings up to 50% in installation costs with the Ortho-77, which means that you can buy the Ortho-77 *installed* for the same price as ordinary fluorescent fixtures.	Installation costs of ordinary fluorescent fixtures average nearly *twice* that of comparable Ortho-77 installations. Although initial costs are in some instances lower, the overall installed cost of the Ortho-77 is favorable.
INSTALLATION	Uni-race sections can precede fixtures to the job. Easily and quickly mounted, they assure positive, permanent straight alignment automatically. Fixtures may be shipped when the building is ready for occupancy and can be hung without tools in minimum time.	In conventional installations, heavy fixtures often must be handled many times on the job. Permanent alignment is frequently difficult to maintain without accessories. Because of the tools and handling necessary, it is difficult to keep fixtures clean in mounting.
FLEXIBILITY	Fixtures of same wattages are interchangeable on the same Uni-Race. Lighting levels can be raised from two to four lite in a matter of minutes, or fixtures can be mounted at spaced intervals and made continuous anytime later without tools in a minimum of time.	Conventional fixtures offer virtually no flexibility in so far as fixture interchange or change of lighting layout is concerned.
MAINTENANCE	Ballast replacement can be made in a matter of minutes by changing fixtures instead of parts. Repairs can be made in the shop at will and service on the line will not be interrupted *even while changing fixtures.*	With conventional fixtures, it is necessary to suspend service on the entire circuit to make repairs. Frequently the working area is disrupted for several hours while this is being accomplished.

GIBSON Manufacturing Co.

1919 PIEDMONT CIRCLE, N. E.
ATLANTA, GEORGIA

WRITE TODAY for descriptive folder giving details of the Ortho-77

Westinghouse lighting equipment for all your applications

. . . FOR PLAYING

This installation at the University of Pittsburgh is a typical multi-purpose arena requiring a flexible lighting system. The Pitt Field House is equipped with removable basketball floor, bleacher sections and is used for varsity and intramural sporting events. 120 Westinghouse *Millites* provide general illumination over the first-floor main area. When the basketball floor is assembled in the center of the gym area, an additional 28 *Millite*® units are energized to increase the illumination level over the playing court.

Architects: Inghome, Boyd & Pratt
Consulting Engineer: E. T. Wieman
Electrical Contractor: Sargent Electric Co.

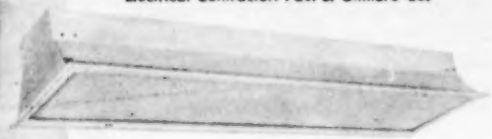
YOU CAN BE SURE... IF IT'S Westinghouse

. . FOR WORKING

The first requirement for this installation was attractive appearance and adequate illumination for detail office work. Westinghouse *TU Troffers* were selected to fit into the low-ceiling architecture and to enhance the over-all appearance.

Result—an attractive, comfortable and efficient lighting installation.

Architects: Benham, Rickards and Armstrong
Consulting Engineers: John Paul Jones, Carey and Miller
Electrical Contractor: Paul L. Gilmore Co.



. . FOR LEARNING

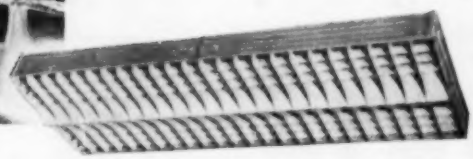
In this school, Westinghouse *CD Luminaires* were selected to achieve high illumination levels with freedom from brightness and glare. With this semi-indirect system, 72% of the light is directed up, making the entire ceiling area a low-brightness light source for the classroom.

Architects: Ebbetts, Frid and Prentice
Consulting Engineers: Hubbard, Lawless, Blakely, Inc.
Electrical Contractor: Albert Anderson

. . FOR SELLING

This retail merchant wanted to increase his sales. Westinghouse *SC Luminaires* were selected to attractively light the merchandise and to compliment the smartly styled interior design. The direct light produced helps his customers see more—and buy more.

Electrical Contractor: Lamb Electric



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PROTECTED BY Bonderite FOR CORROSION RESISTANCE

Remember the Westinghouse electrical contractor's guarantee—he installs them—we back him up.

For more details about commercial, industrial, or flood lighting write Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania.

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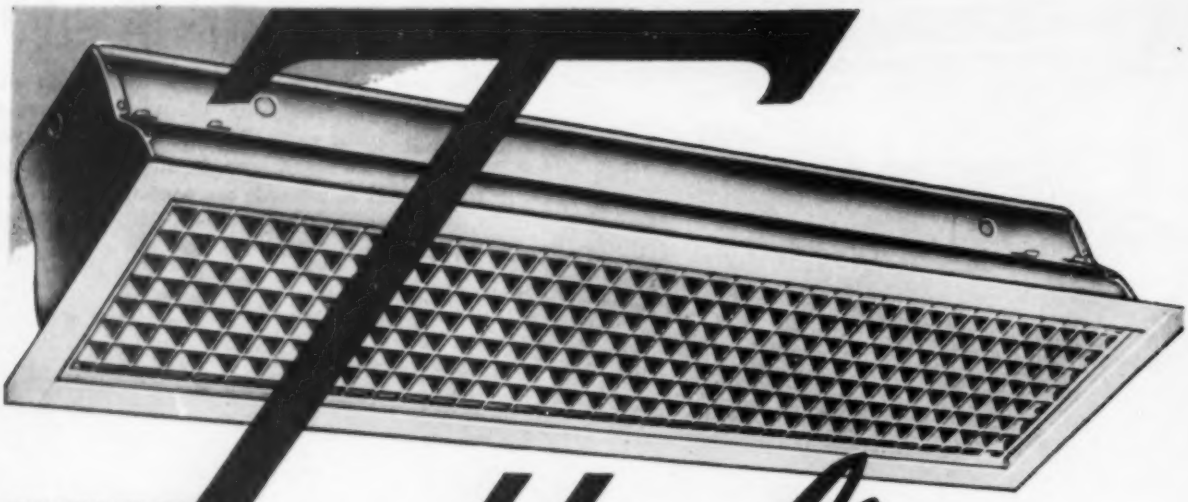

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for Interiors of Distinction

Versatility *plus* efficiency and distinctive appearance . . . that's *Trofferlite.* Offices, stores and commercial establishments of all kinds take on a new look of distinction with these trim, slender units which appear to be a part of the ceiling. There is no limit to the variety of designs, arrangements and architectural effects you can achieve with these recessed Troffers. They are available in a wide range of styles and sizes, in individual units or continuous rows, as shown at left.

For Interiors of Distinction, specify Versatility "*Plus*" . . . specify recessed *Trofferlites.* Complete catalog data sheets sent on request.

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Exclusive licensee of the Leader Line in Canada: Robertson Irwin Limited, Hamilton, Ontario

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Benjamin Electric Mfg. Co., Leader Division, Dept. I Des Plaines, Illinois, also makers of famous Benjamin lighting equipment and sound signals for Industry, Institutions and Commerce.

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Secretary — J. G. MITCHELL, Grant Electric Co., 3016 Payne Avenue, Cleveland, Ohio.

Connecticut Section — Northeastern Region

Chairman — R. O. MILLS, 19 Maynard Avenue, Waterbury, Conn.
Secretary — R. D. BABCOCK, General Electric Company, 185 Church, New Haven, Conn.

Cornhusker Chapter — Midwestern Region

Chairman — R. W. GIBB, Omaha Public Power District, Electric Building, Omaha 2, Nebr.
Secretary — TOM J. FIFER, Westinghouse Electric Supply Co., 117 N. 13th St., Omaha, Nebr.

Eastern New York Chapter — Northeastern Region

Chairman — HAROLD H. FRIEDMAN, 627 Providence St., Albany, N. Y.
Secretary — ALDON P. PUGLIESE, 474 Delaware Avenue, Delmar, N. Y.

Eastern Pennsylvania Section — East Central Region

Chairman — PAUL A. KINSEY, Metropolitan Edison Co., 412 Washington St., Reading, Pa.
Secretary — JOHN L. BEAVER, Metropolitan Edison Co., 412 Washington St., Reading, Pa.

Florida Chapter — Southern Region

Chairman — J. B. FOLEY, General Electric Co., Western Union Bldg., Tampa, Fla.
Secretary — To be announced.

Georgia Section — Southern Region

Chairman — PAUL P. HARRISON, Sylvania Electric Products Inc., 660 Murphy Avenue, Bldg. "D," Atlanta, Ga.
Secretary — WESLEY F. JOHNSON, Georgia Power Co., 75 Marietta St., N. W., Atlanta, Ga.

Hamilton Ontario Chapter — Canadian Region

Chairman — NORMAN BETHUNE, Robertson-Irwin Limited, 411 Parkdale Avenue North, Hamilton, Ont.
Secretary — JOHN TERENCE, Northern Electric Co. Ltd., 157 Main Street E., Hamilton, Ont.

Heart of America Section — Midwestern Region

Chairman — FRANCIS P. O'CONNOR, St. Joseph Light & Power Co., 514 St. Francis St., St. Joseph, Mo.
Secretary — CARL W. THORSELL, Tom Fielder Company, 1195 E. 77th, Kansas City, Mo.

Indiana Chapter — Midwestern Region

Chairman — RALPH E. CROCKETT, General Electric Company, 1115 Circle Tower, Indianapolis, Ind.
Secretary — BYRAN JAQUA, Scott-Jaqua Company, 31 E. Georgia St., Indianapolis, Ind.

Inland Empire Chapter — Pacific Northwest Region

Chairman — JOHN RUFFATTO, Columbia Electrical & Mfg. Co., P. O. Box 2180, Spokane, Wash.
Secretary — GEORGE E. ROMANS, N. 4017 Cedar St., Spokane, Wash.

Iowa Section — Midwestern Region

Chairman — RICHARD HOLCOMBE, Interstate Power Co., 1000 Main St., Dubuque, Ia.
Secretary — MELVIN H. GALBRAITH, 222 First St., N. E., Cedar Rapids, Ia.

Maritime Chapter — Canadian Region

Chairman — E. L. MACELMON, Board of School Trustees, 1 Hazen Ave., St. John, N. B.
Secretary — GEORGE C. ROBINSON, P. O. Box 1064, St. John, N. B.

Maryland Section — East Central Region

Chairman — GEORGE F. WALTER, General Electric Co., 1403 Court Square Bldg., Baltimore, Md.
Secretary — J. CLIFFORD RILEY, Graybar Electric Co., Inc., 100 South St., Baltimore, Md.

(Continued on page 30A)

(Continued from page 29A)

Mexico Chapter

Chairman — To be announced.
Secretary — To be announced.

Miami Valley Chapter—Great Lakes Region

Chairman — E. J. ROMMEL, Dayton Power & Light Co., 305 Gas & Electric Bldg., Dayton, Ohio.
Secretary — D. R. HUGHES, JR., Hughes Simonson Engineering Co., 30 N. McGee St., Dayton, Ohio.

Michigan Section — Great Lakes Region

Chairman — FLOYD W. SELL, Detroit Edison Co., 2000 Second Avenue, Detroit, Mich.
Secretary — HARRY R. ROBBINS, General Electric Co., 1400 Book Tower, Detroit, Mich.

Mid-South Chapter — Southern Region

Chairman — JAMES P. FLETCHER, Flinn, Fletcher, Humphrey, Inc., 606-607 Falls Bldg., Memphis, Tenn.
Secretary — E. W. SCHOENHERR, General Electric Co., 1179 Morehead St., Memphis, Tenn.

Milwaukee Section — Midwestern Region

Chairman — THOMAS B. DUSTIN, 7411 N. Boyd Way, Milwaukee, Wis.
Secretary — WILLIAM LISCH, Lisch Electric Co., 1125 N. 3rd St., Milwaukee, Wis.

Mississippi Chapter — Southern Region

Chairman — HUBERT Q. PRAY, Mississippi Power & Light Co., Jackson, Miss.
Secretary — FRANK SMITH, Mississippi Power & Light Co., Jackson, Miss.

Montreal Section — Canadian Region

Chairman — EWART M. HAACKE, J. A. Wilson Ltg. & Display Ltd., 1235 McGill College Avenue, Montreal, Que.
Secretary — DUNCAN BROOKS, Shortall Electric Co., Ltd., 420 Lagauchetiere St., Montreal, Que.

Mother Lode Chapter — South Pacific Coast Region

Chairman — WILLIAM J. FLYNN, 4067 Cresta Way, Sacramento 21, Calif.
Secretary — JOSEPH K. CANNON, Pacific Gas & Electric Co., 1100 K St., Sacramento, Calif.

New England Section—Northeastern Region

Chairman — E. J. PERKINS, 182 Pond St., South Weymouth, Mass.
Secretary — WARREN K. LEWELLEN, 145 Davis Road, Bedford, Mass.

New Mexico Chapter — Inter-Mountain Region

Chairman — BERT G. ROUGHTON, State Electric Supply Co., Inc., 1024 N. First St., Albuquerque, N. M.
Secretary — G. M. DEKRAKER, Westinghouse Electric Supply Co., Albuquerque, N. M.

New Orleans Section — Southern Region

Chairman — ARTHUR A. LEVY, Interstate Electric Co., 1001 S. Peters St., New Orleans, La.
Secretary — S. CONRAD BERDON, New Orleans Public Service Inc., 317 Baronne St., New Orleans, La.

New York Section — Northeastern Region

Chairman — L. R. ANDERSON, General Electric Co., 570 Lexington Ave., New York, N. Y.
Secretary — G. G. RAE, Holophane Co., Inc., 342 Madison Ave., New York, N. Y.

Northern California Section — South Pacific Coast Region

Chairman — JAMES E. BARNES, Pacific Gas & Electric Co., Corner 4th & "E" Sts., San Raphael, Calif.
Secretary — PAUL S. SCHMIDT, General Electric Co., 999 98th Avenue, Oakland 3, Calif.

Northwestern Ohio Chapter — Great Lakes Region

Chairman — T. W. SMITH, Artopoeus Sales Co., 1627 Crestwood, Toledo, Ohio.
Secretary — RICHARD J. GROSS, Gross Electric Company, 140 Summit, Toledo, Ohio.

Ohio Valley Section — Great Lakes Region

Chairman — BEATTIE M. DELONG, 52 Woodland, Ft. Thomas, Ky.
Secretary — EDWARD J. MCGINNIS, Cincinnati Electrical Assoc., 1107 Union Trust Bldg., Cincinnati, Ohio.

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Chairman — WILLIAM E. SHORT, Collins & Gould, 224 E. 4th St., Tulsa, Okla.
Secretary — F. ALLEN WHITESIDE, Black & West, Architects, 205 Tri-State Insurance Bldg., Tulsa, Okla.

Oregon Section — Pacific Northwest Region

Chairman — MARVIN S. PRESTWOOD, JR., Portland General Electric Co., 621 S. W. Alder St., Portland, Ore.
Secretary — D. D. MOORE, Benjamin Electric Mfg. Co., 4408 S. E. 113th St., Portland, Ore.

Ottawa Chapter — Canadian Region

Chairman — L. C. DUPUIS, Canadian Westinghouse Co., Ltd., 239 Argyle, Ottawa, Ont.
Secretary — C. R. THORNTON, 245 Tudor Place, Kingsview Park, Eastview, Ottawa, Ont.

Palmetto Chapter—Southern Region

Chairman — ROY E. HALLMAN, Westinghouse Electric Supply Co., 205 Airport Road, Greenville, S. C.
Secretary — GLEN M. RIOS, Huntington & Guerry Electric Co., 230 Buist St., Greenville, S. C.

Philadelphia Section — East Central Region

Chairman — WESTERMAN MCCOUCH, 675 Roxborough Avenue, Philadelphia 28, Pa.
Secretary — W. R. MACKINNEY, Westinghouse Electric Corp., 3001 Walnut St., Philadelphia, Pa.

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Chairman — CARL J. LONG, 1050 Century Bldg., Pittsburgh, Pa.
Secretary — JAMES P. BOYDEN, JR., Westinghouse Electric Corp., 306 Fourth Avenue, Pittsburgh, Pa.

Puget Sound Section — Pacific Northwest Region

Chairman — CHARLES C. FIELDS, Love Electric Co., 732 Pacific Ave., Tacoma, Wash.
Secretary — DON A. PEARSON, General Electric Co., 202 Hoge Bldg., Seattle, Wash.

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Chairman — J. D. THERIAULT, Quebec Power Company, 229 St. Joseph St., Quebec, Que.
Secretary — PHILIPPE ROY, Mobec Limited, 466 St. Vallier, Quebec, Que.

Rochester Section — Great Lakes Region

Chairman — ROYAL M. CONHEADY, 140 Curtis St., Rochester, N. Y.
Secretary — FREDERICK B. HOLCOMB, JR., General Electric Supply Corp., 67 Mortimer St., Rochester, N. Y.

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Chairman — CHARLES O. WOODWORTH, Public Service Co. of Colorado, 900 15th St., Denver, Colo.
Secretary — L. J. CARLON, Albert Sechrist Mfg. Co., 1717 Logan St., Denver, Colo.

St. Louis Section — Midwestern Region

Chairman — BROOKS CHASSAING, 911 Locust St., Room 301, St. Louis, Mo.
Secretary — ROBERT J. WELCH, R. J. Welch Co., 3808 W. Pine Blvd., St. Louis, Mo.

San Diego Chapter — South Pacific Coast Region

Chairman — J. WALTER HOWARD, General Electric Co., 1240 7th Avenue, San Diego, Calif.
Secretary — GORDON S. KIMBALL, San Diego Gas & Electric Co., 861 6th Avenue, San Diego, Calif.

San Jacinto Section — Southwestern Region

Chairman — H. D. WEISSER, General Electric Co., 1811 C & I Life Bldg., Houston, Texas.
Secretary — V. P. FLYNN, Graybar Electric Co., Inc., 1702 Cullen, Houston, Texas.

San Jose Chapter — South Pacific Coast Region

Chairman—GENE SMITH, Buckles-Smith Company, 240 Spencer Avenue, San Jose, Calif.
Secretary — GEORGE E. BAKER, Pacific Gas & Electric Co., 87 S. Third St., San Jose, Calif.

Southeast Florida Chapter — Southern Region

Chairman — FURNA E. LOTT, P. O. Box C-347, Kendall, Fla.
Secretary — JAMES A. FORRESTER, 5991 S. W. 81st St., Miami, Fla.

Southern California Section — South Pacific Coast Region

Chairman—F. EDWIN BLAIR, 3705 Cartwright St., Pasadena, Calif.
Secretary — GEORGE A. HOCHENAUER, Benjamin Electric Mfg. Co., 923 E. Third St., Los Angeles 13, Calif.

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Chairman — CLARENCE F. HOKE, Crews-Beggs Dry Goods Co., 316 N. Main St., Pueblo, Colo.
Secretary — JOHN H. RHEUFF, Rheuff Electric Co., 410 N. Santa Fe Avenue, Pueblo, Colo.

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Chairman — JOHN G. FELTON, JR., Sylvania Electric Products Inc., 100 Fordyce St., Dallas, Texas.
Secretary — JOHN B. DECK, JR., Texas Power & Light Co., P. O. Box 6331, Dallas, Texas.

Tennessee Valley Section—Southern Region

Chairman — WILLIAM H. RIDLEY, Nashville Electric Service, 605 Church, Nashville, Tenn.
Secretary — CHARLES H. PATTERSON, 300 Dumberland Circle, Donelson, Tenn.

Toronto Section — Canadian Region

Chairman — M. K. STRANG, Curtis Lighting Co. of Canada Ltd., 195 Wickstead Avenue, Leaside, Ont.
Secretary — BRUCE I. MCCALL, Mitchell Mfg. Co. Ltd., 19 Waterman Avenue, Toronto, Ont.

Twin City Section — Midwestern Region

Chairman — DON R. SCHWARZ, Westinghouse Electric Corp., 727 2nd Avenue No., Minneapolis, Minn.
Secretary — A. A. ARONSON, Northern States Power Co., 360 Wabasha, St. Paul, Minn.

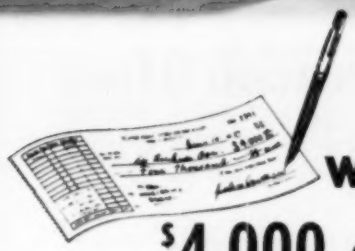
Twin Ports Chapter — Midwestern Region

Chairman — ORVIN D. HANKE, General Electric Co., 1010 Fidelity Bldg., Duluth, Minn.
Secretary — R. G. ROOKWOOD, Superior Water & Light, Superior, Wisc.

Utah Chapter — Inter-Mountain Region

Chairman — MARVIN DANSIE, Oberg Electric Co., 614 Dooly Bldg., Salt Lake City, Utah.
Secretary — WAYNE P. MULCOCK, Utah Power & Light Co., 138 S. Main St., Salt Lake City, Utah

(Continued on page 38A)



would you turn down a savings of $4,000 on a $40,000 lighting expenditure?

You can enjoy the benefits of the *finest* lighting money can buy and effect really substantial savings at the same time, simply by buying the *right* lighting fixture. Time and again, the better design and efficiency of Smithcraft Fluorescent Fixtures result in *fewer units* to produce recommended lighting levels.

Here's an actual case history of how a Pennsylvania department store saved 10% in initial costs and 10% in operating costs . . . or approximately $4000 on a ten-year $40,000 expenditure.

Before re-lighting, a complete survey was made and exact lighting requirements were established. To meet these requirements, Smithcraft units and units of several nationally-known top quality manufacturers were subjected to an exhaustive *comparative* analysis. Here are the results:

10% *FEWER UNITS REQUIRED*

Number of units required to achieve recommended lighting levels: ..... Smithcraft — **270**
2nd Best Fixture — 297
3rd Best Fixture — 339

10% *LESS INSTALLATION COST*

Proportionately less labor and materials were required to install the 270 Smithcraft units than the 297 units of the nearest competitor.

10% *FEWER LAMPS*
(Initial & Replacement)

Lamps required: ..... Smithcraft — **706**
2nd Best Fixture — 776
3rd Best Fixture — 914

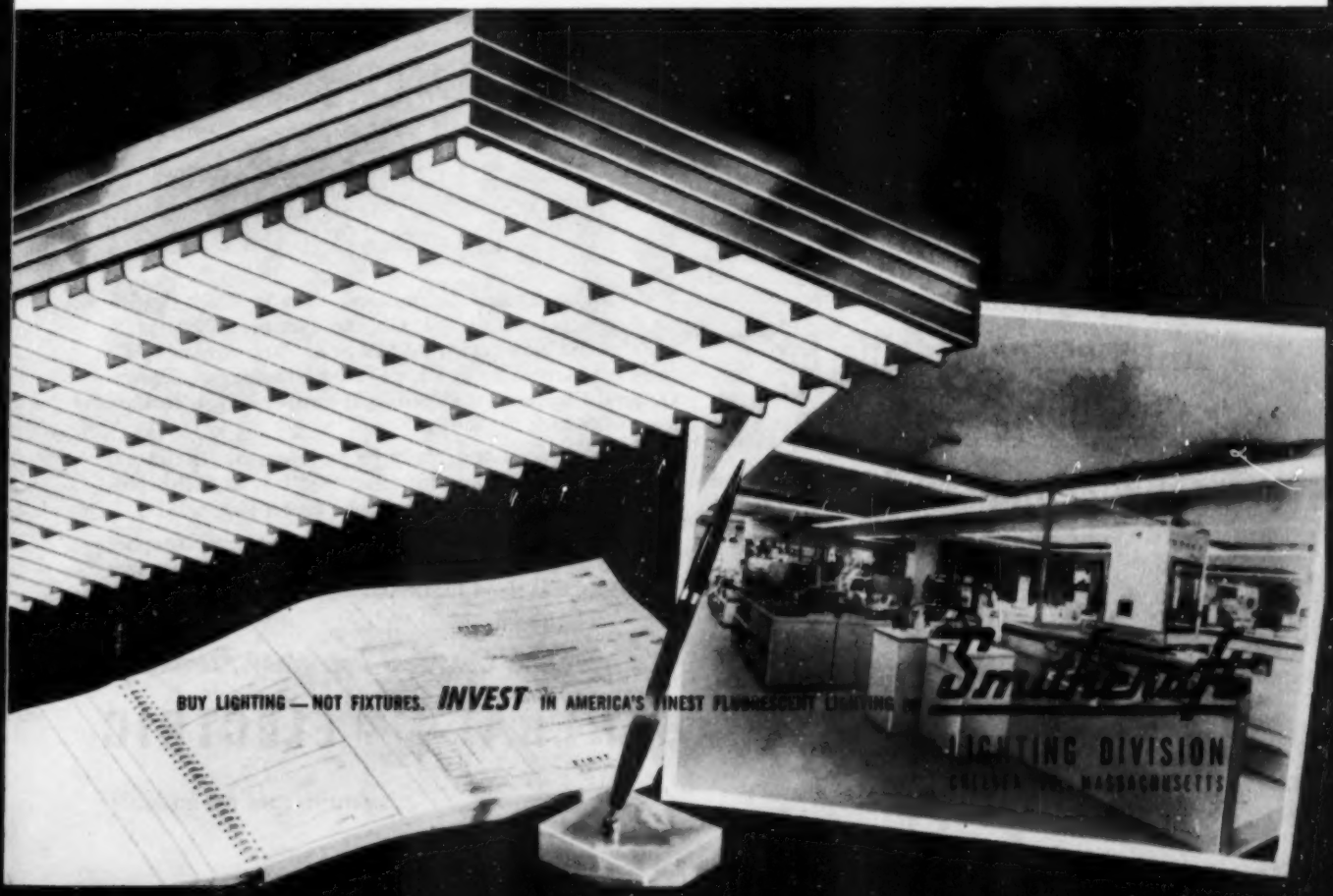
Recommended practice is to replace lamps every 18 months—a continuing 10% savings.

10% *LESS POWER CONSUMPTION*

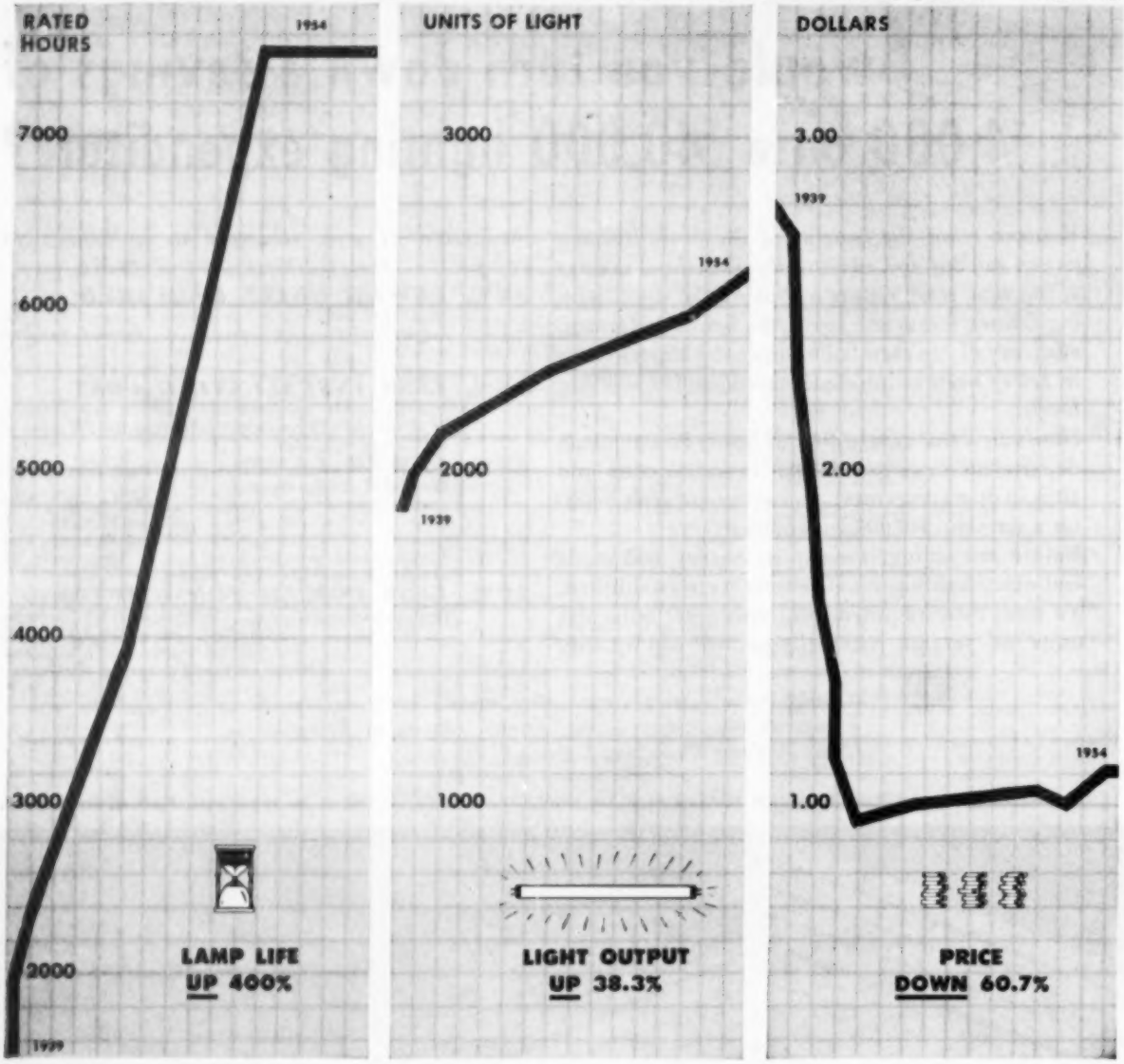
Required wattage: ..... Smithcraft: **51.3** kilowatts
2nd Best Fixture: 56.3 kilowatts
3rd Best Fixture: 64.8 kilowatts

Whether you're lighting a store, office, school, factory, or institution, it pays to *buy lighting — not fixtures.* Invest in Smithcraft — America's Finest Fluorescent Lighting Equipment.

PHOTOGRAPH SHOWS AN INTERESTING PATTERN ARRANGEMENT OF THE SMITHCRAFT LOUVERLITE SLIMLINE IN THE PENNA. DEPT. STORE DESCRIBED ABOVE.



YOU EXPECT THE BEST VALUE FROM G-E FLUORESCENT LAMPS



16 times more value for your fluorescent lamp dollar than in 1939

Today you don't have to pay more than $1.10 for the finest fluorescent lamp made: General Electric. Fifteen years ago it would have cost you $2.80 or $1.70 more. And while price has been going down, we've been pushing quality up. General Electric has upped light output 38%, increased lamp life 400%.

In terms of what you really judge lamps by, a General Electric 40-watt fluorescent lamp that lists at $1.10, plus tax, today is a *16-times bigger value than it was in 1939.*

For further information, contact your G-E lamp supplier or write to Lamp Division, General Electric, Department 166-IE-10, Cleveland 12, Ohio.

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GENERAL ELECTRIC

TO GET YOUR MONEY'S WORTH WHEN YOU BUY LIGHTING EQUIPMENT...

...Look for the Label

The label is your certification that the equipment has been continuously tested by E.T.L. and meets the rigid specifications adapted by the manufacturers for your protection.

Since 1896, E.T.L. has been making impartial tests. E.T.L. has served manufacturers and users of light-sources, lighting fixtures, auxiliary equipment, portable lamps, and other electrical products.

Today, the scope of E.T.L. services has widened to include not only electrical, electronic and photometric testing, but physical and chemical as well. Besides testing, it also includes inspection, standardization and calibration, and certification.

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INSTALLATION: Fanny Farmer Candy Store, 50th St. & 6th Ave., New York City, New York.

DESIGNER: Lippincott & Margulies.

ELECTRICAL CONTRACTOR: Reksal Electric Company.

FIXTURES: Litecontrol Luminous Lens Ceiling Panels, 45" x 48", each using 4-3 lamp 48" slimline fixtures, and 16 Holophane No. 9015 lenses in lucite frame.

WATTS PER SQUARE FOOT: 3.1.

APPROXIMATE REFLECTANCES: Wall (Wallpaper), 63%. Floor(Beige-grey terrazzo), 10%.

AVERAGE INTENSITY: 63 footcandles initially at counter height.

BRIGHTNESS: (One of center lenses).
Normal to lamps, at 30°, 1.0 candle per square inch.
at 45°, 2.07 " " " "
Parallel to lamps, at 30°, 1.0 " " " "
at 45°, 1.99 " " " "

LIGHT

—for Sight and Sales

. . . with Fixtures by LITECONTROL

Lighting by LITECONTROL is an important member of the sales staff in this Fanny Farmer store.

LITECONTROL'S Luminous Lens Ceiling Panels bathe every surface in a flattering, even illumination . . . show merchandise in its *best* light, without ugly shadows, glare or harsh contrasts.

Note entire surface of each panel is aglow. Holophane No. 9015 Low Brightness Lenses make display light but not bright, just right for sweet selling.

Why not discover for yourself the selling magic in standard lighting fixtures that are fashioned right for good sight, good looks and easy maintenance — see your local LITECONTROL Representative.

LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

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The Answer to Your Dimmer Switchboard Requirements

. . . simple mounting
. . . easy electrical connections
. . . individual or master control
. . . cool, efficient flickerless operation

POWERSTAT DIMMER
TYPE D6000H

Work with your switchboard builder — inform him of the advantages of POWERSTAT dimming.

POWERSTAT

INTERLOCKING
Light Dimming Equipment

POWERSTAT INTERLOCKING Dimmers are the finest dimming equipment you can buy . . . for your new switchboard . . . or to add to your present board.

Like all POWERSTAT Dimmers, these are continuously-adjustable auto-transformers. They do not use up power in wasteful heat. They *transform* it into the exact intensity of light you want. They are simple to install . . . inexpensive to maintain . . . easy to operate.

INTERLOCKING POWERSTAT Dimmers are available in 2500 and 6000 watt ratings. Get full details in Bulletin D754I. Send coupon today.

See the Superior Electric's Mobile Display when it is in your area.

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5104 Demers Ave., Bristol, Conn.

Manufacturers of: Powerstat Variable Transformers • Stabiline Automatic Voltage Regulators • Voltbox A-C Power Supplies • Powerstat Light Dimming Equipment • Varicell D-C Power Supplies • Superior 3-Way Binding Posts

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5104 Demers Ave., Bristol, Conn.

Please send me Bulletin D754I on POWERSTAT INTERLOCKING Light Dimming Equipment.

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Company Name.....

Company Address.....

City.....Zone.....State.....

BEWARE THIS REVOLTING VOLT-URE

The revolting Volt-ure perches in plants and pecks away at profits, unless you see to it that good lamp maintenance is constantly observed*, and that you are well supplied with lamps of unquestioned quality — efficient, dependable, long-lasting CHAMPION Lamps.

*Simple, practical suggestions for making the most of your lamps and lighting are contained in the *Champion Maintenance Manual*. May we mail you a free copy?

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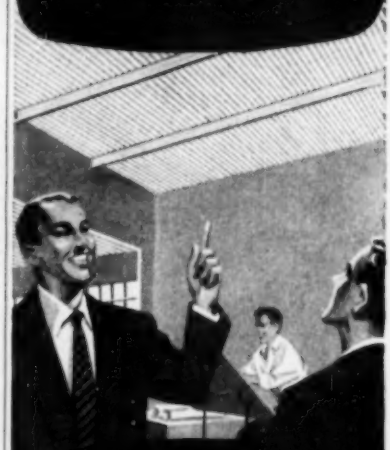
588 Broad Street, Lynn, Massachusetts

CHAMPION

Specify

Acusti-luminus ceilings!



for LOW-COST CONTROL of LIGHT, SOUND and AIR FLOW

THE OVERALL CEILING OF LIGHT THAT INCREASES OVERALL EFFICIENCY!

Here is the trend in modern lighting! A solid ceiling of light that provides soft, shadowless illumination and also hides pipes, ductwork and sprinkler systems — it modernizes old and new buildings!

Made of unbreakable, corrugated LUMI-PLASTIC with noise absorbing ACUSTI-LOUVERS, it is glareproof, clean and easy to keep clean—labeled by Underwriters' Laboratories for installation *under* existing sprinkler systems!

Its low cost is quickly offset because people *see better, feel better, work better* under an ACUSTI-LUMINUS CEILING. Already over 3500 in use.

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Dept. I 2500 W. North Ave., Chicago 47, Ill.
Tell me where I can see it!

Send me your free booklet containing complete details about the ACUSTI-LUMINUS CEILINGS!

Name and title_____

Firm name_____

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Photograph by Consolidated Edison

You get Permanence, Quality, Beauty with PLEXIGLAS

This luminous-area lighting at the County Trust Company, Mt. Vernon, N.Y., illustrates the important advantages obtained with PLEXIGLAS acrylic plastic diffusers.

Permanence. Rigid, strong and durable, PLEXIGLAS is noted for freedom from discoloration, and resistance to breakage. It has a firm, solid appearance in harmony with other room surfaces.

Quality Illumination. PLEXIGLAS provides maximum transmission of light and complete, edge-to-edge diffusion that accents the quality of architectural design.

Beauty. Lighted or unlighted, PLEXIGLAS is pleasing to the eye—the most beautiful of all types of plastics.

For the *best* in illumination, specify PLEXIGLAS diffusers for luminous ceiling areas and large-area lighting equipment for indoor or outdoor use. We will be glad to send you detailed information on this multipurpose lighting material.

PLEXIGLAS is a trade-mark, Reg. U.S. Pat. Off. and in other principal countries in the Western Hemisphere.

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(Continued from page 30A)

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Secretary — WALTER E. BEEK, British Columbia Electric Co., Ltd., 1501 Douglas St., Victoria, B. C.

Virginia Chapter—East Central Region

Chairman — JACK DOWNING, Westinghouse Electric Corp., 1108 E. Main St., Richmond, Va.

Secretary — R. T. MCCRONE, General Electric Co., 627 E. Main St., Richmond, Va.

Western Michigan Chapter — Great Lakes Region

Chairman — W. F. HARPER, 1216 Philadelphia Avenue, S. E., Grand Rapids, Mich.

Secretary — L. G. THOMPSON, 945 Petrie Avenue, Muskegon, Mich.

Western New York Section — Great Lakes Region

Chairman — BERNARD H. PLANTE, 112 Hamilton Drive, Snyder, N. Y.

Secretary — BYRON F. LYTH, JR., Niagara Mohawk Power Corp., 535 Washington St., Buffalo, N. Y.

Winnipeg Chapter — Canadian Region

Chairman — JAMES SERNE, Winnipeg and Central Gas Co., 265 Notre Dame St., Winnipeg, Man.

Secretary — G. L. GOOD, Northern Electric Co., Ltd., 65 Rorie St., Winnipeg, Man.

The McKinley 2&4 Lamp

4 & 8 FT. LUMINOUS INDIRECT LUMINAIRES—

- Modern designer styling, creative engineering and fine craftsmanship are combined into a unit of exceptional beauty and high overall efficiencies.
- Curved panels of white, ribbed polystyrene give high reflectivity and produce a luxurious quality of illumination.
- The illuminated unit blends into the ceiling since its surface brightness and that of the ceiling are nearly equal.
- Unit is below the minimum brightness specifications of Illuminating Engineering Society.

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FLUORESCENT INCANDESCENT

Lighting

REPRESENTATIVES IN PRINCIPAL CITIES • WHOLESALERS EVERYWHERE

About People

(Continued from page 24A)

positions: **George F. Niemann**, Works Manager; **Alva H. Meyer**, Manager of Manufacturing Engineering; **Carle E. Rackley**, Chief Engineer; **Clement P. Mors**, General Superintendent; **Henry A. Flentge**, Production Manager; **Eric H. Church**, Manager of Industrial Engineering; **Raleigh I. Klipstein**, Plant Engineer; **James R. Chambers**, Sales Promotion and Advertising Manager.

Walter L. Cisler, president of the Detroit Edison Co., has been named to receive the George Westinghouse Gold Medal Award of the American Society of Mechanical Engineers. The award, which is administered by the Board on Honors of ASME, is given, when warranted, for eminent achievement or distinguished service in the power field of mechanical engineering, including contributions in the utilization, application, design development, research and organization and administration of power facilities.

Dr. Richard Feinberg, President of Northern Illinois College of Optometry, was re-elected to a second term on the National Board of Examiners in Optometry. He will serve for five years. One of the special National Board assignments being processed by Dr. Feinberg is the study of the feasibility of making optometric aptitude tests available through the National Board to all college students considering optometry as a career.

H. C. McDaniel has been appointed manager of technical information for Westinghouse Electric Corp., replacing **C. A. Scarlott**, who has resigned to accept the position of manager of technical information services at the Stanford Research Institute, Palo Alto, Calif.

Jerry W. Martin and **Julius B. Trotter** have joined the staff of Darell Boyd Harmon and Associates, Austin, Texas, industrial consultant in education, human performance, research and design in the school field. Mr. Martin, formerly Assistant Professor of Marketing and Transportation at the University of Texas, will be management consultant with the Harmon organization. Mr. Trotter will serve as science writer and editor of technical report series.

D. A. Hills has been appointed Southeastern representative and sales engineer for Luminous Ceilings, Inc., Chicago, in the states of Georgia, Florida and part of Alabama. Mr. Hills will have headquarters at 590 Sherwood Road, N. E., Atlanta, Georgia.

Ralph E. Butler has been appointed to the post of executive Vice-President of Unistrut Products Co., 1013 W. Washington Blvd., Chicago. Previous to this appointment, Mr. Butler was Vice-President of the company's Eastern Sales Division. Other promotions announced by Unistrut are those of **John P. Heslin,** formerly of the Western Division, who has been named Vice-President in charge of sales; and **A. J. Croze,** Vice-President of engineering sales, who has been promoted to the post of Vice-President in charge of engineering.

Henry A. Klopot, formerly manufacturers' representative in Boston, Mass., has joined Century Lighting Inc., in Santa Monica, Calif., with headquarters at 1840 Berkeley St. Mr. Klopot, who was active in the New England Section, I.E.S., will now serve the Society in the Southern California Section.

Walter G. McKie, General Sales Manager of Rochester Gas and Electric Corp., Rochester, N. Y., has been appointed Chairman of the Home Lighting Education Committee of the Better Light Better Sight Bureau. Mr. McKie has been associated with the B.L.B.S. program since 1934.

Alex Quiroga, Lighting Director with the American Broadcasting Co. Television Div., and member of the Southern California Section, I.E.S., has been awarded the first annual graduate scholarship at Johns Hopkins University, Baltimore. This scholarship is awarded to one individual who will spend a year at the University engaged in study and research in the psychol ogy and physics of color.

John E. Mueller has been promoted to manager of policy administration, a newly-created position on the executive staff of the West Penn Power Co., Pittsburgh, Pa. In the new position, Mr. Mueller will be responsible for the development of policy and organization relationships for West Penn, which recently underwent an extensive reorganization.

James J. Dugan has been named Detroit District Manager of the Federal Pacific Electric Co. Previously Mr. Dugan was employed with Westinghouse Electric Corp. in the petroleum and chemical section of the Industry Sales Dept. and earlier had worked for several years in the equipment sales section of the company's switchgear division.

A Frank P. Brown Medal will be awarded to **Humboldt W. Leverenz,** Director of the Physical and Chemical Research Laboratory, RCA Laboratories, Princeton, N. J., by the Franklin Institute of the State of Pennsylvania. The medal, which honors inventors for meritorious improvement in the building and allied industries, will be presented to Mr. Leverenz on October 20 at the Institute's annual Medal Day ceremonies. Accompanying the award is a citation which reads: "In consideration of his outstanding contribution to the development of the fluorescent lamp, particularly by the invention of efficient, reliable, long-lasting and versatile phosphors."

Professor Harold O. Bolz of Lafayette, Indiana, assumed his duties, October 1, as the new Associate Dean of the College of Engineering of Ohio State University. The position he fills has been newly authorized by the Board of Trustees of the University. As one of these new duties, Professor Bolz will act as counsellor to third and fourth year students in the College of Engineering, and supervise planning and organization of University-industry conferences.

(Continued on page 42A)

SUNBEAM
visionaire
STILL TIME TO SPECIFY SUNBEAM LIGHTING
The steel frame is going up. It's still not too late to recommend Sunbeam quality lighting as you probably planned originally.
Write for bulletin #721.
Specify Sunbeam's new, 4-foot square, recessed light cells, #1155DP3800. The smooth, translucent white Plexiglas diffusing panels fit smartly in contemporary commercial interiors. Easy to install, these "large area" units produce high intensity, low brightness illumination.
SUNBEAM LIGHTING COMPANY
777 East 14th Pl., Los Angeles 21, Calif.

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LIGHTING FIXTURES
Commercial and Industrial

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WILEY DESIGNED
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Modern, functional designs to harmonize with any architectural motif.

Stock fixtures adaptable for all lighting layouts.

Units designed for quick, easy erection; a minimum of "on the job" assembly.

Patented E-Z Servicer.

District Sales Engineers available for prompt cooperation.

Designed and Completely manufactured by WILEY, pioneers in Fluorescence since its inception—with ETL Certified Electrical Components.

FOR FULL INFORMATION
WRITE
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Underwriters' Approved IBEW (A.F. of L. Label)—Fleur-O-Lier Certified Models

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HIDING YOUR LIGHT UNDER A BUSHEL?

This may be your opportunity to shine!

We are one of the industry's leading manufacturers of street and airport lighting equipment.

We are looking for a DISTRICT MANAGER . . .

YOU may be the man!

If you are:

YOU will have had previous lighting equipment sales experience.

YOU will be strongly promotion-minded.

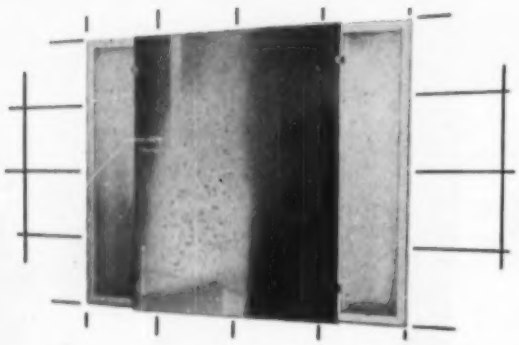
YOU will be free to travel half the time covering the Western half of the U.S.

YOU will headquarter in a large Mid-Western city amid pleasant surroundings and with congenial associates.

YOU will receive an equitable salary, a bonus and participate in an excellent retirement plan plus all the usual fringe benefits.

If the above sounds like YOU, we'll arrange an interview at your convenience. Just drop a line, including a recent photo to **Box 224, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.**

MILWAUKEE FLUORESCENT BATHROOM CABINET



The only cabinet with *four* 20-watt lamps!

Now you can easily specify good lighting for the bathroom, too! The Milwaukee cabinet provides completely recessed lighting—for glareless, shadowless illumination. With *four* 20-watt fluorescent lamps, no other illumination is ordinarily needed in the bathroom. For all other facts on this most modern of bathroom cabinets, write for bulletin B-108. Or see your electrical wholesaler . . . today.

CHECK THESE SPECS: Uses four 20-watt lamps, shielded with Corning Alba-Lite translucent opal glass. Trigger-start G.E. ballasts. All-welded 20-gauge cold rolled steel. Mitered corners, filled and polished. Double-baked white lifetime enamel finish. Mirror of mirror-glazing quality polished plate glass. Polished edge glass shelves. U/L approved. Union made. G.E. electrical equipment. 110-120 volts, 60 cycle a-c. Individually packed. Requires a wall opening of 30⅛ x 24⅛ x 4 in.

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COMPANY
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1661 N. WATER ST.

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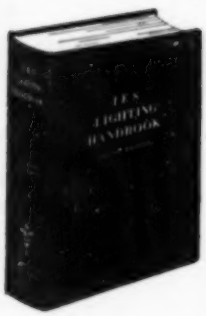

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Prepared by I.E.S. technical committees, this 987-page lighting compendium contains 18 sections of lighting practice, theory and calculations . . . Appendices . . . Manufacturers' Reference Data . . . 655 photos, drawings, lighting tables, charts, graphs, to help you solve tough lighting problems.

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POSITION WANTED

Illuminating Engineer, B.S.E.E., age 29, family. Experienced in design, application and testing of lighting equipment. Presently employed but desires position with greater responsibility. Will relocate. Address Box 222, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

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To train one to two years for work involving a combination of creative sales engineering, application, promotion and administrative type work with leading fixture manufacturer. Prefer man under 30. Engineering degree or equivalent required. Directly applicable experience may shorten training period. Excellent opportunity for advancement. Salary. Address Box 223, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

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To design street lighting luminaires and equipment and assist department manager. Must have B.S. degree and thorough knowledge of utility street lighting operation. Age 25 to 40. Salary open. Eastern Massachusetts. Please give complete information in first letter. Address Box 225, Publications Office, Illuminating Engineering Society, 1860 Broadway, New York 23, N. Y.

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Wanted to represent old established manufacturers of fluorescent and incandescent Commercial lighting fixtures of the "Engineered" variety. Large comprehensive catalog. Special work encouraged. Following among Engineers, Architects and distributors desirable. Territories open in New Jersey, Penn., Delaware, Maryland, D. of C., Virginia, W. Virginia, Kentucky, Indiana, Mississippi and all states west of the Mississippi excluding Texas. Write Kent Metal Manufacturing Co., Inc., 490 Johnson Avenue, Brooklyn 37, New York.

Keeps Lamps Cooler, Cleaner, Longer

Air automatically circulates around the lamp and through the slotted neck of the ABOLITE Reflector to keep dust and grime from settling. Lamp and reflector surfaces stay cleaner twice as long. There's less maintenance; 7% more up-light.

LONGER LAMP LIFE

Constant air circulation in ABOLITE Reflectors keeps lamp necks 40°F. cooler, provide maximum lamp life.

WHITER THAN WHITE

Floods More Light

ABOLITE Titanium white porcelain enamel finish reflects maximum light — provides highest lighting efficiency.

There's an ABOLITE for every lighting requirement . . . ask your jobber for complete details.

ABOLITE Lighting DIVISION
THE JONES METAL PRODUCTS CO.
WEST LAFAYETTE, OHIO

Provides Engineered Cove Lighting
AT A NEW LOW PRICE*

VISIONAIRE is a unique fluorescent fixture engineered to meet the structural and mechanical problems encountered in cove lighting that cannot be solved with conventional equipment.

VISIONAIRE is, in reality, a prefabricated lighting system available in easily installed unit lengths of 24, 33 and 48 inches to present an unbroken line of light, extremely decorative in effect.

The bottom louvered opening provides efficient down-wall lighting, while the metal side reflector, which may be either luminous or opaque, provides soft, even, over-all indirect lighting without any trace of glare.

In new construction or on a remodeling project, VISIONAIRE with its low initial cost, easy installation and simple maintenance, will "pay its own way" in efficiency, economy and effectiveness.

** The equipment cost for a prefabricated Visionaire lighting system is, on the average, under five dollars per foot . . . a considerable saving on ordinary built-in cove lighting that provides neither the efficiency, nor the fine finished appearance of Visionaire.*

FOR COMPLETE DETAILS

For complete details on Visionaire, send for this informative bulletin sheet No. 521S-11. It contains construction, performance and application data that will help you put Visionaire to its most effective use. Address request to Dept. V. . . .

SILVRAY LIGHTING, INC.

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"You wouldn't believe it was the same office!"

BEFORE...
Glaring, noisy loft-type office.
WHAT A DIFFERENCE!
AFTER...
SYLVAN-AIRE System brings soft, comfortable working light . reduces noise levels, too.

New SYLVAN-AIRE Lighting System improves sight and sound ...quickly installed!

Architects and business executives acclaim the transformations made with Sylvania's advanced SYLVAN-AIRE System.

This lighting system consists of translucent, corrugated plastic supported by light-weight aluminum channels. Longitudinal "V"-shaped Sono-Wedges, filled with glass fiber also greatly reduce distracting noise.

The structural elements of the SYLVAN-AIRE System are designed for suspension from either single or multi lamp units, necessary to supply the proper level of illumination.

There's lots more you should know about the extreme versatility, efficiency and ready installation of SYLVAN-AIRE. For illustrated literature address 4X-3510 at Sylvania.

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University Tower Building, St. Catherine Street, Montreal, P. Q.

LIGHTING • RADIO • ELECTRONICS • TELEVISION

(Continued from page 39A)

Four Southern California I.E.S. members have contributed to the education of students at the Los Angeles College of Optometry recently, by lecturing, on separate occasions, on illumination at the college. These are: **Robert Ford**, Smoot-Holman Co.; **Frank van Gilluwe**, Holophane Co.; **Foster Sampson**, Consulting Engineer; and **Roy Kreyser**, Illuminating Consultant with the Bureau of Water and Power.

Standard Electrical Supply Corp. has appointed **Jerome Epstein**, Illuminating Engineer formerly with the Great Northern Mfg. Co., to the position of Vice-President in charge of the newly created lighting fixture department and showroom. The company is located at 2150 W. Belmont Ave., Chicago, Ill.

Thomas G. Hearn has been named sales manager of the fluorescent fixture manufacturing department of Sylvania Electric Products Inc., and will have his headquarters at the company's new plant in Wheeling, W. Va. Previously affiliated with Niagara Hudson Power Co., Mr. Hearn joined Sylvania in 1947. The firm also announces the appointment of **Charles I. Brady** as district sales manager for lighting products in the combined New York City-Newark area, with headquarters at Sylvania's recently completed sales office and warehouse at 1000 Huyler St., in Teterboro, N. J.

John D. van der Veer has been appointed assistant general sales manager of Tung-Sol Electric Inc., Newark, N. J. His former position as manager of initial equipment electron tube sales is being filled by **J. M. Malone**, who in turn is being succeeded by **Arthur Keckeissen** as manager of the production, order and service department.

John A. White, Jr., and **S. E. Gardner** have been appointed as representatives for Pittsburgh Reflector Co., Pittsburgh, Pa. Mr. Gardner, from headquarters in Los Angeles, will cover the entire Southern California area. He is being transferred from the Chicago area of the company. Mr. White, formerly with General Electric Supply Co., will have his headquarters at the company's New York City offices, covering the northern and central New Jersey area.

California Reinforced Plastics Co. has recently purchased the Honeylite Co., whose aluminum honeycomb product will be sold through their Sales Division, Hexcel Products Co., 951 Sixty-First St., Oakland, Calif., **Roger C. Steele**, President.

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five happy men

the architect
"I like the design possibilities."

the lighting engineer
"Variety in size, shielding and number of lamps gives me complete flexibility."

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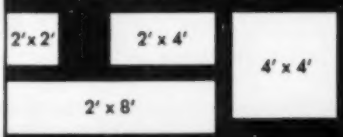
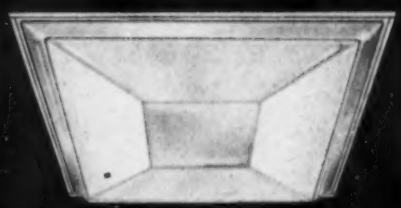
"Easiest installation of any recessed fixture."

the maintenance man—"Easy hinging makes my job easier."

the owner—"Good-looking, good lighting . . . and surprisingly low in cost."

and GARCY'S new 5600 Series Recessed Lighting





Variety in size and in number of lamps

2 ft. wide units for 2, 3 or 4 lamp rows; 4 ft. x 4 ft. units for 6, 8 or 10 lamp rows. Rapid start, slimline or fluorescent lamps.

NEW!

For any type of ceiling construction . . . plaster, aluminum grid and others

"The big five" on any lighting job, range from the man who pays the bills to the architect who picks the fixture.

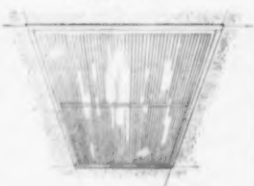
Garcy's 5600 Series, by design, provide the kind of desirable features that make 'em happy, and keep them that way.

Design and lighting flexibility win a pleased nod from architects and engineers. Easy installation in any type of ceiling scores with contractors. Easy maintenance is a big feature for those concerned with upkeep. And the man who pays the bills is mighty happy with the handsome appearance and long-life construction details.

"Quality . . . *by design*" in Garcy's 5600 Series fixtures has the knack of pleasing everyone. Send for bulletin L-146.

THREE TYPES OF SHIELDING
(Hinged plastic pictured above)

Hinged louver



Alba-lite glass in hinged frame

GARCY *Quality by Design*

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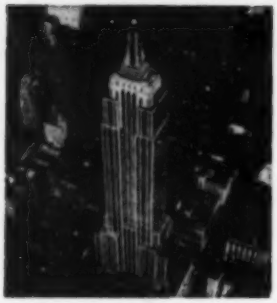
*Lighting that makes the nation's most important buildings come alive



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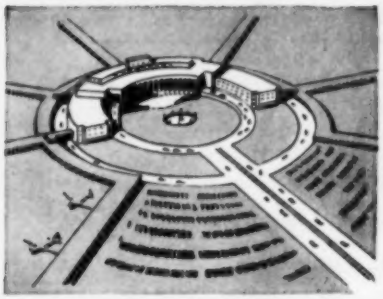

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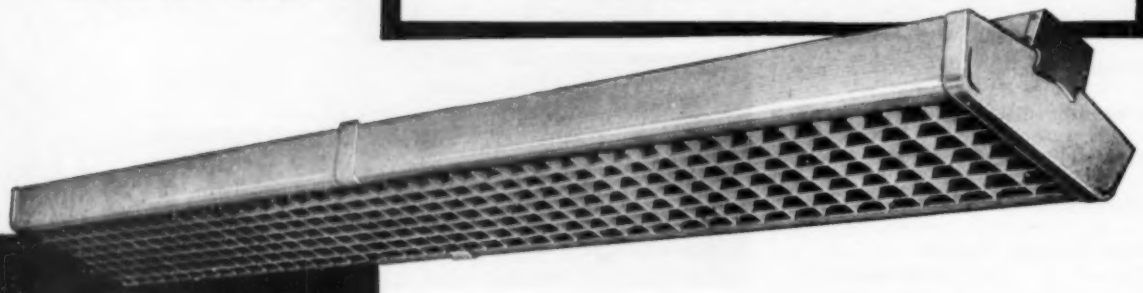

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see our catalog in $ SWEET'S LIGHT CONSTRUCTION FILE or write for copy

PHILITE

MEMBER N.E.M.A.

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provides you with Specification Data covering

4 ESSENTIALS to GOOD LIGHTING EQUIPMENT PERFORMANCE

and the names of manufacturers from whom you can secure such equipment

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● Everyone who buys, sells and specifies industrial lighting equipment should have a copy of this helpful 52-page reference work. It contains nationally-recognized standard specifications for 75 types and sizes of industrial lighting units. Each one of these specifications incorporates the first three of the four "Essentials to Good Performance" listed at the left.

The RLM Specifications Book also explains fully *why* the RLM Label on lighting units is a Warranty for Uniform High Quality. It points out why you can rely on RLM-Labeled units of the same manufacturer to maintain a certain quality level within your lighting system. Knowing that you can depend on such uniform quality, saves time, money and labor, in terms of such factors as uniformity of illumination, minimum service interruptions, low operating and low maintenance costs.

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R741

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300 F.C. with only
1.11 C.P./Sq. In. Brightness

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In our own showrooms we've installed a 15' x 16' GrateLite Ceiling. By switching on various lamp arrangements we can deliver from 28 to 300 foot-candles 7' 9" below the GrateLites. Measurements at right give GrateLite efficiency figures and brightness readings at 30° and 45° below the ceiling.

GrateLite recessed louvre construction is in a class by itself for modern high intensities, safely within comfort ranges plus a high degree of diffusion.

AREA: 15' x 16' (240 Sq. Ft.)
GRATELITES: Suspended 18" below ceiling
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LUMINAIRES: Guth M-5385/TO
ROOM COLORS: 3 walls—light green—50% R. F. Floor—15% R. F.

Test No.	Lamps	Lamp Watts	Foot-Candles		Efficiencies	Brightness	
			30°	45°		30°	45°
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

It's all in the light-saving tubes—and only GrateLite has them!

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